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ABSTRACT

The guide, designed for sixth, seventh, or eighth grade teachers and students, presents six science instructional units for career exploration related to the occupational clusters manufacturing (2), communication, transportation, health and agribusiness. The units deal specifically with: the scientific method for research, using the scientific method for research, systems analysis, air transportation, duties of a medical assistant, and energy from natural resources. Each unit is based on behavioral objectives which are stated as terminal objectives, dealing with the subject matter to be covered, and as specific objectives, dealing with the student performance necessary to reach the terminal objective. The other components of each unit are: list of suggested activities for instructor and student, reference list, information sheets outlining the content of the unit, assignment sheets providing specific written activities, job sheets providing creative projects, answers to assignment sheets a unit test, and answers to the test. Some units also contain transparency masters. Instructions for using the guide and forms and guidelines for field trips, interviews, and resource people are included. (MS)

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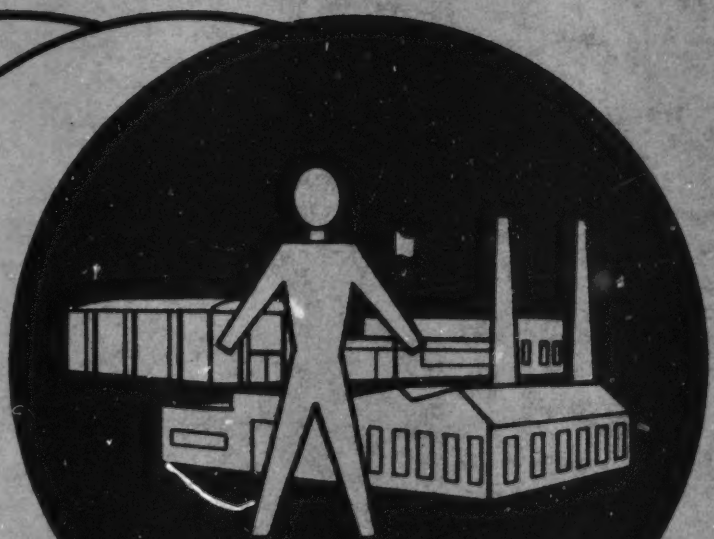
Career Education

Science



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STATE DEPARTMENT OF VOCATIONAL AND TECHNICAL EDUCATION/STILLWATER, OKLAHOMA

CAREER EDUCATION SCIENCE

UNITS FOR CAREER EXPLORATION IN SIXTH, SEVENTH OR EIGHTH GRADE

Development and Revision
Coordinated by:
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State Department of Vocational-Technical Education
Stillwater, Oklahoma
1974

OKLAHOMA STATE BOARD OF VOCATIONAL AND TECHNICAL EDUCATION
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(NOTE: These units need not be taught in any specific order. However, the two units on Manufacturing should be used together.)

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INTRODUCTION

In the school-based model of career education, students should be ready for the career exploration stage at approximately grades seven and eight. Career exploration should be part of the daily curriculum infused into the major subject areas to help students become aware of occupations that lead from the subject areas.

One of the key concepts of career education is for every teacher in every course to emphasize the contribution that subject matter can make to a successful career. This publication is designed to help the classroom teacher achieve this concept.

In the exploration phase of career education students are exposed to basic concepts needed for success in the occupational cluster. Exposure to basic concepts is accomplished through hands-on activities, field trips, work observations, role playing, and simulations. This approach helps the students to understand themselves in relation to the educational and occupational alternatives, including the occupational outlook available to them.

These units are not intended to replace present subject matter content but rather to enhance the learning of subject matter skills. It is our belief that student motivation can be increased by making curriculum more relevant to his lifetime career needs.

Field Testing

An intensive two day workshop was held in July, 1973, at Central State University in Edmond, Oklahoma, for teachers committed to field test these units during the 1973-74 school year. During the workshop teachers were oriented to the concepts of career education and to the format for these materials. The teachers also received training for teaching a unit of instruction.

The materials were field tested by selected teachers from the following schools during the 1973-74 school year: Central Junior High School, Bartlesville; Orlando Junior-Senior High School; Blackwell Junior High School; Lindsay Junior-Senior High School; Jefferson, Rogers, and Eisenhower Middle Schools, Oklahoma City; and Irving, Longfellow, and Whittier Middle Schools, Norman. The career education curriculum staff worked closely with the teachers during field testing. Evaluations were collected and revisions were made as recommended.

Field Trips and Resource Personnel

It is suggested that both field trips and guest speakers be utilized as much as possible for the geographic area. These activities allow students to relate to people who work at various jobs and to see people in their work environments. Emphasis for both field trips and guest speakers should be on the worker rather than on the product. For example, on a field trip to a factory attention should be directed toward the workers there, what they do, how they receive their training, how one worker depends on many others, and what they like or dislike about their jobs.

The teacher is responsible for guiding the choice of field trips and guest speakers and for selecting the time at which the students will profit most from the experience. To become familiar with the place to be visited and the things to be seen, the teacher should, if possible, investigate the field trip site by taking the trip in advance. Permission

for a trip must be obtained from the school principal, the person in charge of the place to be visited, and the parents of the students.

Students can be taught some general interviewing techniques which can be used for interviewing workers on a job or resource persons brought into the classroom. Precautions should be taken to see that students do not disturb the workers too much. Specific students could be assigned to interview certain kinds of workers and then report to the entire class. Plans for interviewing should be cleared with the business prior to the visit. It may be advisable to provide the resource site or resource speaker with a list of questions the students are likely to ask.

Some sample forms and questions are provided on the following pages. These can help the teacher prepare for more effective utilization of field trips and resource personnel.

BUSINESS SURVEY SHEET

1. What is the name of your business?_____

   A. Address_____

   B. Phone_____

2. Who should be contacted to arrange a visit to your business?

   _____

   A. Position with firm_____

   B. Phone_____

3. Would someone be able to visit the classroom to prepare for the trip or follow it up?_____

4. For what age children is the tour appropriate?_____

5. How many can be accommodated at one time?_____

6. How many school groups can be handled per year?_____

7. What is the best time of year to visit?_____

8. What is the best time of week to visit?_____

9. What is the best time of day to visit?_____

10. How much time is needed for the visit?_____

    What is the cost to the pupils?_____

    To the school?_____

11. Are there facilities for meals?_____

    Is there ample parking space?_____

    A. Bus_____

    B. Car_____

12. Do you have special exhibits, film, tapes, etc. that could be used for instructional purposes? If so, what are the subjects and how may they be secured?

    _____

    _____

Questionnaire (continued)

13. Brief description of the tour _____

_____

_____

14. Is guide service provided? _____

15. Are there any special safety precautions to be observed during the visit? _____

_____

16. In what other ways can the business and industries of this area contribute to the education of our young? _____

_____

_____

_____

17. What can the school community do for you? _____

_____

_____

_____

_____

x

PERMISSION SLIP FOR FIELD TRIPS
(to parent or guardian)

School _____
Teacher _____
Grade _____

_____ has my permission to participate in career
(Student's Name)
exploration field trips with the Industrial Arts classes for the _____ school year.

Signed,

_____ _____
(Date) (Parent or Guardian)

FIELD TRIP REQUEST
(to authorized school personnel)

DATE:_____

SCHOOL:_____TEACHER_____ROOM___

Business or Industry to be visited:_____

_____

_____ Phone:_____

Special Areas of Interest:_____

_____

_____

_____

Date(s) requested_____Date(s) confirmed_____

Grade Level_____Age_____Size of Group_____No. of Adults_____

Type of Transportation needed (bus or walk)_____

Leave (time)_____Return (time)_____

APPROVED: _____ Counselor

_____ Building Principal

_____ Office of Superintendent

DISAPPROVED: _____

REASON: _____

_____

_____

RESOURCE SITE OBSERVATIONS

(NOTE: Distribute to students prior to field trip. These guidelines may also be used for personal interviews.)

1. The number of different jobs in existence at the resource site.
2. The number of people employed in each job.
3. Nature of the work done.
4. Whether a particular job is expanding or declining.
5. Educational and training requirements.
6. The route to getting a particular job.
7. Age requirements to work in different areas.
8. Physical requirements.
9. Hours per week employees are required to work.
10. Opportunities for advancement.
11. Whether union or other membership is required.
12. Vacation time allotted.
13. Whether or not there are health insurance and retirement or pension plans.

PREPARATION FOR INTERVIEWS

The following is a list of helpful hints for teachers and pupils when preparing for interviews:

1. Teachers should be aware and make students aware that misinformation may result from an interview. The worker may misunderstand the questions, or he may not have the detailed information that the student is seeking.

2. It may be helpful to send the resource person a list of questions the class is considering.

3. Familiarize pupils with questions and have them mark the questions they would like to ask.

4. Inform pupils before an interview that the resource person does not have to answer a question if he does not want to.

5. Teachers should be alert to step in and help facilitate communication if either the student or resource person is not understanding what the other has said.

6. The teacher should feel free to clarify questions and answers whenever it is desirable to do so.

7. Pupils should be given the opportunity to discuss the reason why a worker may oversell or undersell his field, such as a need to impress his listeners, a lack of information due to limited experiences in the field, or a need to rationalize his own success or failure on the job.

QUESTIONS FOR RESOURCE PEOPLE

(NOTE: These questions could be utilized by students when interviewing a resource person.)

1. What do you do on the job?
   a. What time did you go to work this morning?
   b. What was the first thing you did?
   c. How long did that take (cover the entire day)?
   d. Did you do anything yesterday that was different from today?
2. Why did you take this job?
3. Was this your first job choice?
4. How many times did you change your mind about what you wanted to be before you went to work?
5. What part of your job do you like best? Is there a part of your job you do not like? Are there any hazards?
6. Who depends upon your work?
7. What experiences and training on this job might prepare you for some other kind of job should you ever want to change?
8. Do you work nights and days?
9. Are you tired when you get home? On your job do you have to be nice to people who are crabby and ill-mannered?
10. What inventions could put you out of work?
11. Are people with your kind of skills usually needed even when business may be bad? Is your work at all seasonal? Is this type of work limited to geographical areas?
12. What type of education is necessary for this work?
13. What classes did you have in the sixth grade that help you now in your work?
14. Is there any personal quality required for this job?
15. In general, what are the starting salaries in this type of work?
16. When does your boss compliment you or when do you compliment your employees?
17. When are people fired?
18. What school did you attend?

19. What changes have taken place recently?

20. Do you expect any changes in the near future?

21. What qualifications do you need to get your job, such as

    a. Age

    b. Height

    c. Weight

    d. Sex

    e. Marital status

    f. Veteran

    g. Union

    h. License

22. Is it permissible to get another employee to cover your job if you want time off?

23. Did any of your leisure activities increase your ability to obtain this job or help you to perform better on this job?

24. Did you have to make a decision between two or more jobs?

25. Is there anything we need to know about the job that has not been asked?

USE OF THIS PUBLICATION

Instructional Units

The Science curriculum includes five instructional units. Each instructional unit includes behavioral objectives, suggested activities for teacher and students, information sheets, assignment sheets, visual aids, tests, and answers to the test. Most units are planned for approximately ten hours of instruction.

Careful study of each instructional unit by the teacher will help him determine:

A. The amount of material that can be covered in each class period
B. The skills which must be demonstrated
    1. Supplies needed
    2. Equipment needed
    3. Amount of practice needed
    4. Amount of class time needed for demonstrations
C. Supplementary materials, such as pamphlets and filmstrips, that must be ordered
D. Resource people who must be contacted

Objectives

Each unit of instruction is based on behavioral objectives. These objectives state the goals of the course thus providing a sense of direction and accomplishment for the student.

Behavioral objectives are stated in two forms: Terminal Objectives stating the subject matter to be covered in a unit of instruction and Specific Objectives stating the student performance necessary to reach the terminal objective.

Since the objectives of the unit provide direction for the teaching-learning process, it is important for the teacher and students to have a common understanding of the intent of the objectives. A limited number of performance terms have been used in the objectives for this curriculum to assist in promoting the effectiveness of the communication among all individuals using the materials.

Following is a list of performance terms and their synonyms which were used in this material:

Name	Identify	Describe
Label	Select	Define
List in writing	Mark	Discuss in writing
List orally	Point out	Discuss orally
Letter	Pick out	Interpret
Record	Choose	Tell how
Repeat	Locate	Tell what
Give		Explain

Order	Distinguish	Construct
Arrange	Discriminate	Draw
Sequence		Make
List in order		Build
Classify		Design
Divide		Formulate
Isolate		Reproduce
Sort		Transcribe
		Reduce
		Increase
		Figure

Demonstrate
Show your work
Show procedure
Perform an experiment
Perform the steps
Operate
Remove
Replace
Turn off/on
(Dis) assemble
(Dis) connect

Reading of the objectives by the student should be followed by a class discussion to answer any questions concerning performance requirements for each instructional unit.

Teachers should feel free to add objectives which will fit the material to the needs of the students and community. When a teacher adds objectives, he should remember to supply the needed information, assignment and/or job sheets, and criterion tests.

Suggested Activities

Each unit of instruction has a Suggested Activities sheet outlining steps to follow in accomplishing specific objectives. The activities are listed according to whether they are the responsibility of the instructor or the student.

Instructor: Duties of the instructor will vary according to the particular unit; however, for best use of the material they should include the following: provide students with objective sheet, information sheets, assignment sheets, and job sheets; preview filmstrips, make transparencies, and arrange for resource materials and people; discuss terminal and specific objectives and information sheets; give test. Teachers are encouraged to use any additional instructional activities and teaching methods to aid students in accomplishing the objectives.

Students: Student activities are listed which will help the student to achieve the objectives for the unit.

Information Sheets

Information sheets provide content essential for meeting the cognitive (knowledge) objectives of the unit. The teacher will find that information sheets serve as an excellent guide for presenting the background knowledge necessary to develop the skills specified in the terminal objective.

Students should read the information sheets before the information is discussed in class. Students may take additional notes on the information sheets.

Transparency Masters

Transparency masters provide information in a special way. The students may see as well as hear the material being presented, thus reinforcing the learning process. Transparencies may present new information or they may reinforce information presented in the information sheets. They are particularly effective for such activities as learning and locating the parts of a machine.

Transparencies should be made and placed in the notebook where they will be immediately available for use. Transparencies direct the class's attention to the topic of discussion. They should be left on the screen only when topics shown are under discussion. (NOTE: Stand away from the overhead projector when discussing transparency material. The noise of the projector may cause the teacher to speak too loudly.)

Assignment Sheets

Assignment sheets give direction to study and furnish practice for paper and pencil activities to develop the knowledge which is a necessary prerequisite to skill development. These may be given to the student for completion in class or used for homework assignments. Answer sheets are provided which may be used by the student and/or teacher for checking student progress.

Test and Evaluation

Paper-pencil and performance tests have been constructed to measure student achievement of each objective listed in the unit of instruction. Individual test items may be pulled out and used as a short test to determine student achievement of a particular objective. This kind of testing may be used as a daily quiz and will help the teacher spot difficulties being encountered by students in their efforts to accomplish the terminal objective. Test items for objectives added by the teacher should be constructed and added to the test. Progress sheets are provided for student and teacher to record acceptable performance of skills outlined in job sheets.

Test Answers

Test answers are provided for each unit. These may be used by the teacher and/or student for checking student achievement of the objectives.

SCIENCE IN MANUFACTURING
THE SCIENTIFIC METHOD FOR RESEARCH

TERMINAL OBJECTIVE

After completion of this unit, the student will be able to list the steps in the scientific method and solve a given problem by using the scientific method. This knowledge and experience will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms and definitions used in the scientific method and scientific approach to solving problems.
2. Write two reasons for scientific research.
3. List in order the five steps in the scientific method.
4. Solve a given problem by using the scientific method.

This unit was written by Linda Scott and Georgia Pattison in a class at Central State University under the supervision of Dr. Richard Mitchell, Professor of Education.

SCIENCE IN MANUFACTURING
THE SCIENTIFIC METHOD FOR RESEARCH

SUGGESTED ACTIVITIES

I. Instructor:

A. Provide students with objective sheet.

B. Provide students with information and assignment sheets.

C. Discuss terminal and specific objectives.

D. Discuss information and assignment sheet.

E. Explain procedure and demonstrate the use of the scientific method.

F. Give test.

II. Student:

A. Read objective sheet.

B. Study information sheet.

C. Complete assignment sheet.

D. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

A. Objectives

B. Information sheet

C. Assignment Sheet #1--Identify the Steps of the Scientific Method

D. Answers to assignment sheet

E. Test

F. Answers to test

II. References:

A. Lux, Donald G. and Willis E. Ray. *The World of Manufacturing.* Bloomington, Illinois: McKnight and McKnight Publishing Company, 1971.

B. Brown, Walter R. and Norman D. Anderson. *Life Science: A Search for Understanding.* New York: J.B. Lippincott Company, 1971.

SCIENCE IN MANUFACTURING
THE SCIENTIFIC METHOD FOR RESEARCH

INFORMATION SHEET

I. Terms and definitions

A. Research--The process of collecting, describing, and experimenting in order to develop or discover new knowledge

B. Technology--The use of science to produce new knowledge or products for the benefit of man

C. Hypothesis--An educated guess or likely answer to the problem

D. Theory--A well established and accepted explanation to a problem

E. Data--All available information collected on a problem

F. Conclusion--A final decision or answer to a problem, usually based on results from experimentation

II. Reasons for scientific research

A. To satisfy man's wish to understand his physical surroundings

B. To add to the knowledge needed to solve problems important to man's health and safety

C. To invent process or products to satisfy man's wants and needs

III. Five steps in the scientific method

A. Stating the problem

B. Collecting information about the problem

C. Forming hypotheses

D. Experimenting

E. Establishing a theory; making a conclusion or answer

Example: You are reading in bed and your lamp suddenly goes out. What has happened?

At this point you may stop and state the problem which is step one of the scientific method

INFORMATION SHEET

1. Bed lamp has gone out; what is the cause?

You can gather information about the problem, which is step two of the scientific method.

2. The lamp uses a 60 watt light bulb. The lamp is plugged in to the wall socket behind your bed.

Then you may begin to guess what has happened. You can make several hypotheses, which is step three of the scientific method.

3. a. The electrical power has failed.

   b. The plug on the lamp cord has come unplugged.

   c. The light bulb has burned out.

It is easy to eliminate the first two. You notice that the other lights in the house are on, indicating that there has not been a power failure. You check the plug and find that it is properly inserted in the electrical outlet. Therefore, your best guess is that the bulb has burned out.

You decide to test this idea by experimenting, which is the fourth step in the scientific method.

4. You test the idea by experimenting with the bulb from another lamp, which we will call Lamp B. You first check to make sure that Lamp B has the same type of bulb as your lamp, which we will now call Lamp A. You switch bulbs and see if the bulb from Lamp B will work in Lamp A.

If the bulb from Lamp B works in Lamp A, you may conclude that the light bulb from Lamp A was burned out. This would prove your hypothesis, and you can make a statement or theory about the answer to your problem. Your conclusion is step five of the scientific method.

5. The light bulb from Lamp A was burned out. It did not work when placed in Lamp B, while the bulb from Lamp B worked in Lamp A.

SCIENCE IN MANUFACTURING
THE SCIENTIFIC METHOD FOR RESEARCH

ASSIGNMENT SHEET #1--IDENTIFY THE STEPS OF THE SCIENTIFIC METHOD

Read the following story, then identify the five steps of the scientific method. Write each step out clearly as if you were solving the problem yourself.

In 1747 it was a well-accepted idea that scurvy was caused by the lack of certain foods, but it was not known yet which foods should be eaten to prevent the disease. It was known though that sailors who ate only flour, salted meat, and fish were suffering from scurvy.

An effort was made to determine what the sailors should eat to prevent them from getting scurvy. Twelve sailors were chosen who all had the same degree of scurvy. All the sailors received the same food. In addition to the basic diet, two sailors ate nutmeg each day, two drank a small quantity of sea water, and two ate oranges and lemons. Only the two who ate the lemons and oranges recovered.

Many years later it was discovered that part of the fruit which prevented scurvy was a complex chemical molecule, Vitamin C.

From the story above:

1. State the problem.

2. List the information given about the problem.

ASSIGNMENT SHEET # 1

3. State the hypothesis.

4. How was the hypothesis tested?

5. What was the conclusion or answer to the problem?

SCIENCE IN MANUFACTURING
THE SCIENTIFIC METHOD FOR RESEARCH

ANSWERS TO ASSIGNMENT SHEET

1. What foods could prevent scurvy.

2. a. It was known that the lack of certain foods caused scurvy.

   b. Flour, salted meat, and fish did not prevent scurvy.

3. Fruit or spices might prevent scurvy.

4. Twelve sailors, all with the same degree of scurvy, were given the same basic meal, but two were given salt water, two given nutmeg, and two were given oranges and lemons.

5. Only the two who ate oranges and lemons recovered. Oranges and lemons would help prevent scurvy.

SCIENCE IN MANUFACTURING
THE SCIENTIFIC METHOD FOR RESEARCH

TEST

1. Match the terms on the right to the correct definition.

_____a. An educated guess or likely answer to the problem.

_____b. A final decision or answer to a problem based on results from experimentation

_____c. The process of collecting, describing, and experimenting in order to develop or discover new knowledge

_____d. All available information collected on a problem

_____e. The use of science to produce new knowledge or products for the benefit of man

_____f. A well established and accepted explanation to a problem

1. Technology
2. Hypothesis
3. Theory
4. Data
5. Research
6. Conclusion

2. Write two reasons for the need for scientific research.

a.

b.

3. List in order the five steps of the scientific method.

a.

b.

c.

d.

e.

4. Solve the following problem by using the scientific method.

Election winner--

The board of elections in a small town consists of five men: Smith, Jones, Brown, Peters, and Thompson. At their first meeting last fall, they sat around a table in the order just given. They decided to elect a new chairman.

The first ballot was a stand-off. Each man received a single vote. No one voted for either of his immediate neighbors at the table or for himself. On the second ballot, each man stuck to his original choice except for Brown, who now voted for Thompson. Thus Thompson became chairman. The question is: Who voted for Jones on the first ballot?

(You might like to use a drawing in one of your steps to help you see it through.)

SCIENCE IN MANUFACTURING
THE SCIENTIFIC METHOD FOR RESEARCH

ANSWERS TO TEST

1. a. 2
   b. 6
   c. 5
   d. 4
   e. 1
   f. 3

2. Any two of the following are acceptable.
   a. To satisfy man's wish to understand his physical surroundings.
   b. To add to the knowledge needed to solve problems important to man's health and safety.
   c. To invent process or products to satisfy man's wants and needs.

3. a. Stating the problem
   b. Collecting information about the problem
   c. Forming hypotheses
   d. Experimenting
   e. Establishing a theory

4. a. Stating the problem. Who voted for Jones on the first ballot.
   b. Information or data may include:
      1) Five men in the following seating arrangement: Smith, Jones, Brown, Peters, and Thompson.
      2) Sitting around a round table, electing a chairman.
      3) First ballot was a stand-off; each man received a single vote
      4) No man voted for the man sitting next to him

5) Every one stuck to the original vote except Brown

6) Brown changed his vote to Thompson

7) Thompson became chairman

c. Guess or Hypothesis. Since neither Brown or Smith could vote for Jones (because they were neighbors), it has to be either Tompson or Peters. Let's say: Peters.

d. Experimentation. (A drawing can be made to show it more easily.)

1) From the information, we know that Brown changed his vote to Thompson; so that means he must have voted for Smith the first time.

2) If Smith received a vote from Brown the first time, then he could not have received a vote from Peters.

3) If Peters did not vote for Smith and he could not vote for his neighbors, he had to have voted for Jones.

e. Conclusion or Theory. On the first ballot Peters voted for Jones.

1) Brown, on the second time, changed and voted for Thompson; he had to vote for Smith the first time.

2) Since Peters cannot vote for Thompson or Brown because they are neighbors, he had to vote for Jones.

SCIENCE IN MANUFACTURING
USING THE SCIENTIFIC METHOD FOR RESEARCH

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to test for and determine the amount of Vitamin C in certain foods. Using the scientific method, the student will research, with certain foods and under special conditions, basic procedures on maintaining a high content of Vitamin C. This knowledge will be evidenced through research experiments, demonstrations, and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Define terms associated with Vitamin C content research.
2. List four food sources which contain Vitamin C.
3. List three jobs that play an important part in Vitamin C research.
4. Demonstrate the ability to:
   a. Determine which foods contain more Vitamin C.
   b. Analyze how boiling affects the amount of Vitamin C in foods.
   c. Analyze Vitamin C loss in orange juice.

This unit was written by Linda Scott and Georgia Pattison in a class at Central State University under the supervision of Dr. Richard Mitchell, Professor of Education.

SCIENCE IN MANUFACTURING
USING THE SCIENTIFIC METHOD FOR RESEARCH

SUGGESTED ACTIVITIES

I. Instructor:

A. Provide students with objective sheet.

B. Provide students with information and job sheets.

C. Discuss terminal and specific objectives.

D. Discuss and demonstrate examples for research job sheets.

E. Evaluate student according to this data and conclusion on research job sheets.

F. Provide equipment and demonstration for research experiments.

G. Give test.

II. Student:

A. Read objective sheet.

B. Study information sheet.

C. Observe demonstration given by instructor.

D. Complete research experiment job sheets.

E. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

A. Objectives

B. Information sheet

C. Job sheets

1. Job Sheet #1--Determine Which Foods Contain More Vitamin C

2. Job Sheet #2-Analyze How Boiling Affects the Amount of Vitamin C in Foods

3. Job Sheet #3--Analyze Vitamin C Loss in Orange Juice

D. Answers to job sheets

E. Test

F. Answers to test

II. References:

A. Lux, Donald G. and Willis E. Ray. *The World of Manufacturing.* Bloomington, Illinois: McKnight and McNight Publishing Company, 1971.

B. Brown, Walter R. and Norman D. Anderson. *Life Science: A Search for Understanding.* New York: J. B. Lippincott Company, 1971.

SCIENCE IN MANUFACTURING
USING THE SCIENTIFIC METHOD FOR RESEARCH

INFORMATION SHEET

I. Terms associated with Vitamin C content research

A. Vitamin--Organic substance that is essential for the proper nutrition of man and other animals

B. Deficiency disease--A disease caused by the lack of nutrients

C. Scurvy--Disease caused by the lack of Vitamin C

D. Citrus--Fruits containing high amounts of Vitamin C

II. Food sources that contain Vitamin C

A. Cantaloupe

B. Strawberry

C. Tomato

D. Orange

E. Grapefruit

(NOTE: Fruit of the Puerto Rican cherry has the highest concentration of Vitamin C known to man.)

III. Jobs that play an important part in Vitamin C research

A. Research analyst

B. Biochemist

C. Lab technician

D. Pharmacist

SCIENCE IN MANUFACTURING
USING THE SCIENTIFIC METHOD FOR RESEARCH

JOB SHEET #1--DETERMINE WHICH FOODS CONTAIN MORE VITAMIN C

I. Materials

A. Beakers and test tubes

B. Balance

C. Graduate cylinder

D. Eyedropper

E. Indophenol

F. Vitamin C

G. Food to be tested (grapefruit, cantaloupe, strawberries, tomato juice)

(NOTE: Indophenol can be obtained from biochemical supply houses or from the Chemical Division of Eastman Kodak Company; the vitamin source may be in liquid form or pill form.)

II. Procedure

A. Dissolve one gram of Indophenol in 1000 cc. of water. Place 10 cc. of this solution in a clean test tube

B. (Practice trial for testing Vitamin C) Add Vitamin C source drop by drop to the test tube of Indophenol solution until the solution turns colorless

(NOTE: The more Vitamin C source needed to clear the Indophenol, the less Vitamin C that source contains.)

C. Label each test tube with the name of food to be tested

D. As in step B, take each of the food samples and test for the content of Vitamin C

1. In a clean test tube place 10 cc. of Indophenol solution; then drop by drop add the tomato juice to the test tube. Record the number of drops necessary to turn the Indophenol solution colorless. _____ drops.

2. In a clean test tube place 10 cc. of the Indophenol solution. Add the strawberry juice drop by drop until the solution turns colorless. Record the number of drops necessary to turn it colorless. _____drops.

JOB SHEET #1

3. In a clean test tube place 10 cc. of Indophenol solution. Add the cantaloupe juice drop by drop until the solution turns colorless. Record the number of drops necessary to turn the solution colorless. _____drops.

4. In a clean test tube place 10 cc. of the Indophenol solution. Drop by drop add the grapefruit juice to the solution. Record the number of drops it takes to turn the Indophenol solution colorless. _____drops.

III. Questions

A. Which of the four food samples has the most Vitamin C?

B. Which of the four food samples has the least amount of Vitamin C?

C. List in order of the highest Vitamin C content and then indicate how many drops were necessary to turn the Indophenol solution colorless.

	Number of drops
1.	_____
2.	_____
3.	_____
4.	_____

SCIENCE IN MANUFACTURING
USING THE SCIENTIFIC METHOD FOR RESEARCH

JOB SHEET #2--ANALYZE HOW BOILING AFFECTS THE AMOUNT OF VITAMIN C IN FOODS

I. Materials

A. Two cups of orange juice

B. Two cups of tomato juice

C. Indophenol solution (1 gram/1000 cc. of water)

D. Metal cups (2)

E. Hot plate

II. Procedure

A. Place two cups of orange juice in a metal cup. Determine the content of Vitamin C by using the Indophenol solution. Record the number of drops necessary for turning the Indophenol solution colorless. _____drops.

B. Place two cups of tomato juice in a metal cup. Determine the content of Vitamin C by using the Indophenol solution. Record the number of drops necessary for turning the Indophenol solution colorless. _____drops.

C. Boil each cup of juice on hot plate for three minutes.

D. Cool and then re-test each cup.

E. Record number of drops of boiled orange juice necessary to turn the Indophenol solution colorless. _____drops.

F. Record the number of drops of boiled tomato juice necessary to turn the Indophenol solution colorless. _____drops.

G. Compare the number of drops necessary to clear the Indophenol solution after the boiling to the number needed before the boiling.

III. Questions

A. Was there a change in the content of the Vitamin C after boiling?

JOB SHEET #2

B. If the vitamin content was changed after boiling, explain how it was different.

C. Which cup had the least amount of Vitamin C after boiling?

D. What is your conclusion?

SCIENCE IN MANUFACTURING
USING THE SCIENTIFIC METHOD FOR RESEARCH

JOB SHEET #3-ANALYZE VITAMIN C LOSS IN ORANGE JUICE

I. Materials

A. Four 16 oz. containers

B. Fresh orange juice

C. Place of cold storage

D. Five clean test tubes

II. Procedure

A. Determine the concentration of your orange juice by placing 10 cc. of Indophenol solution in a clean test tube. Add drops of the orange juice until it turns the solution clear; then record the number of drops. _____drops.

B. Fill four 16 oz. containers with the fresh orange juice.

C. Label one "Closed - Shelf" and place the lid tightly on it.

Label one "Open - Shelf" and leave the lid off.

D. Label one "Closed - Refrigerator"; place the lid tightly on the container and set in refrigerator.

Label the other "Open - Refrigerator"; leave the lid off and set in refrigerator.

E. Leave all four containers overnight. Next day check each container for Vitamin C content and record how many drops it takes to clear the Indophenol solution. Do this by placing 10 cc. in four clean test tubes and label them as you have done the orange juice containers; then from the correct orange juice container add the drops to the Indophenol solution labeled the same way. Add the drops until the Indophenol solution turns clear; then record the results.

III. Questions

A. Which container had the least amount of Vitamin C after sitting overnight?

JOB SHEET #3

B. Which container had the most Vitamin C?

C. Fill in the data chart

	Number of drops
Concentration of fresh orange juice	_____
Next day: Concentration of "Closed - Shelf"	_____
Concentration of "Open - Shelf"	_____
Concentration of "Closed - Refrigerator"	_____
Concentration of "Open - Refrigerator"	_____

D. Make a statement of conclusion:

SCIENCE IN MANUFACTURING
USING THE SCIENTIFIC METHOD FOR RESEARCH

ANSWERS TO JOB SHEETS

I. Job Sheet #1

A. Cantaloupe

B. Tomato juice

C. 1. Cantaloupe

2. Strawberries (Number of drops will vary with each food.)

3. Grapefruit

4. Tomato juice

II. Job Sheet #2

A. Yes

B. The change was less concentration

C. Tomato juice

D. Heat effects the Vitamin C content. (Heat will readily destroy the content of Vitamin C.)

III. Job Sheet #3

A. Open - Shelf

B. Closed - Refrigerator

C. Data results will vary

D. The Vitamin C content is lost more readily in an open container than a closed container. A cool place with a closed container is helpful in keeping the Vitamin C content in the orange juice

SCIENCE IN MANUFACTURING
USING THE SCIENTIFIC METHOD FOR RESEARCH

TEST

1. Define the following terms associated with Vitamin C content research.

   a. Vitamin–

   b. Deficiency disease–

   c. Scurvy–

   d. Citrus–

2. List four food sources which contain Vitamin C.

   a.

   b.

   c.

   d.

3. List three jobs that play an important part in Vitamin C research.

   a.

   b.

   c.

4. Demonstrate the ability to:

   a. Determine which foods contain more Vitamin C.

   b. Analyze how boiling affects the amount of Vitamin C in foods.

   c. Analyze Vitamin C loss in orange juice.

   (NOTE: If this activity has not been completed prior to the test, ask the instructor when it should be completed.)

SCIENCE IN MANUFACTURING
USING THE SCIENTIFIC METHOD FOR RESEARCH

ANSWERS TO TEST

1. a. Organic substance that is essential for the proper nutrition of man and other animals

   b. A disease caused by the lack of nutrients (vitamins)

   c. A disease caused by the lack of Vitamin C

   d. Fruits containing high amounts of Vitamin C

2. Any four of the following are acceptable.

   a. Orange

   b. Grapefruit

   c. Cantaloupe

   d. Strawberry

   e. Tomato

3. Any three of the following are acceptable.

   a. Research analyst

   b. Biochemist

   c. Lab technician

   d. Pharmacist

4. Performance tasks evaluated by instructor.

SCIENCE IN COMMUNICATION
SYSTEMS ANALYSIS

TERMINAL OBJECTIVE

After completion of this unit, the student should beable to define the terms associated with electrical circuits and systems. He should be able to list the steps or procedures utilized in systems analysis. This will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms and definitions associated with electrical circuits.
2. Draw an electrical circuit indicating current flow.
3. Identify five conductors from a list.
4. List steps involved in systems analysis.
5. Describe one system of communication.

This unit was written by Robert Reilley and Georgia Pattison in a class at Central State University under the supervision of Dr. Richard Mitchell, Professor of Education.

SCIENCE IN COMMUNICATION
SYSTEMS ANALYSIS

SUGGESTED ACTIVITIES

I. Instructor:

A. Provide students with objective sheet.

B. Provide students with information and assignment sheets.

C. Make transparency.

D. Discuss terminal and specific objectives.

E. Discuss information and assignment sheets.

F. Give test.

II. Students:

A. Read objective sheet.

B. Study information sheet and complete each assignment sheet.

C. Complete each assignment sheet.

D. Take test.

INSTRUCTIONAL MATERIALS

I. Provided in this unit:

A. Objectives

B. Information sheet

C. Transparency master: TM 1--An Electrical Circuit

D. Assignment sheets

1. Assignment Sheet #1--Electricity
2. Assignment Sheet #2--Systems
3. Assignment Sheet #3--Communication Systems

E. Answers to assignment sheets

F. Test

G. Answers to test

II. References:

A. Florida State University. *Intermediate Science Curriculum Study.* New York: Silver Burdett, 1970.

B. Weisbruck, et al. *Patterns and Processes in Science.* Book 2. New York: D. C. Heath, 1967.

C. Elementary Science Study Committee. *Batteries and Bulbs.* New York: McGraw-Hill, 1967.

D. Tannenbaum and Stillman. *Experiences in Science - Electricity.* New York: McGraw Hill, 1967.

III. Instructions to the teacher (Materials needed for lab activity):

A. Assignment Sheet #1

1. Necessary materials

a. Insulated copper wire

b. Wire stripper

c. Screw driver

d. Dry cell (1 1/2 volt)

e. Flashlight bulb and socket

f. Buzzer or bell

g. Pencil

h. Paper

i. Piece of iron

j. Jar of salt water

k. Penny

l. Nickel

m. Dime

n. Quarter

o. Rubber comb

p. Piece of plastic

2. Materials for further investigation

a. Alcohol

b. Wires with different thickness

c. Ammeter or voltmeter

B. Assignment Sheet #2 - Materials Necessary

1. Shirt cardboard
2. Thread
3. Corks
4. Masking tape
5. Toothpicks
6. Paper clips
7. Clay
8. Aluminum foil
9. Plastic straws
10. Tongue depressors
11. Rubber bands
12. Straight pins

SCIENCE IN COMMUNICATION
SYSTEMS ANALYSIS

INFORMATION SHEET

I. Terms and definitions

A. Electrons--Invisible bits of electricity

B. Circuit--The flow of electrons from the negative pole to the positive pole

C. Conductor--Material, like wire, which can carry electricity

D. Insulation--Material which will not conduct electricity

E. Short circuit--Break in the flow of electrons in a circuit

F. Complete system--Group of subsystems that work together to perform a given task

G. Subsystem--Two objects which directly affect each other

H. Systems analysis--The study, identification of parts, testing, and evaluation of a system

II. Three parts of an electrical circuit (TM 1, Assignment Sheet #1)

A. A source of energy (battery)

B. Conductor (wire)

C. Energy-using device (lightbulb)

(NOTE: Electrons flow from - to +.)

III. Five conductors of electricity (Assignment Sheet #1)

A. Copper

B. Penny

C. Nickel

D. Wire

E. Dime

IV. Steps necessary for systems analysis

A. Study the system

B. Identify subsystems

INFORMATION SHEET

C. Test system

D. Evaluate the system

V. Use library to find information (Assignment Sheet #3)

An Electrical Circuit

SCIENCE IN COMMUNICATION
SYSTEMS ANALYSIS

ASSIGNMENT SHEET #1--ELECTRICITY

INTRODUCTION

It's a great world, man. Electricity does everything, it seems. You almost can turn night into day with electric lights. The latest "sound" comes over your radio, which is run by electricity.

It is certainly hard to think of a world without electricity. But less than a hundred years ago people lit their homes with candles or lamps that burned gas or kerosene. And there were no radios or TV's. Food was kept cold in ice boxes. When the ice melted, the ice man would deliver a new block of ice to put in the ice box.

Less than a hundred years ago, we entered the age of electricity. It didn't happen all at once. It took a long time until most people had electricity in their homes.

Perhaps the most famous person in the world of electricity was Thomas A. Edison, the inventor. Among his many inventions were the phonograph, motion pictures, and the electric light bulb. The interesting thing about Edison and the light bulb was this. While he was working on it, he was also busy inventing ways to send electricity from a power station to homes, offices, and factories. He knew that people would not use his light bulb if they could not get electricity cheaply and easily. So Edison also built the first electric power plant and an underground wiring system.

To begin a study of electricity, you can look to Edison. Edison worked on three kinds of things. First, he made generators, machines that make electricity. For most of your experiments, you will use batteries or dry cells to make your electricity. (The electricity from wall sockets at school and at home is a little too powerful and somewhat dangerous for these tests.)

Edison also had to have a way to get electricity from his generators to where it was to be used. To do this, he used wires. You'll be using wires to do the same thing.

Finally, Edison invented something that used electricity, the electric light bulb. You won't have to invent things, but you will be making things like light bulbs and electric games.

ASSIGNMENT SHEET #1

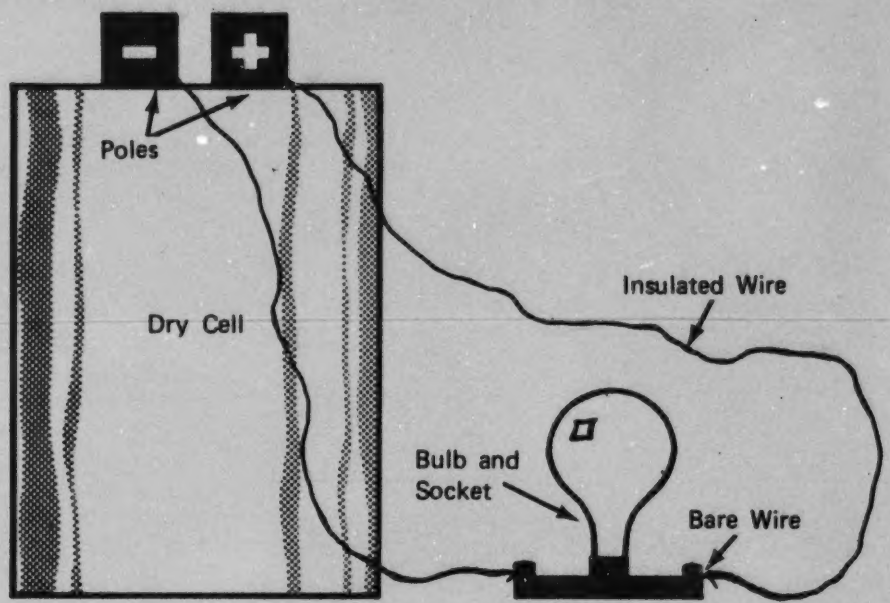
Take a flashlight bulb and socket and hook it up to a dry cell to make the bulb light up.

(NOTE: Use wire that has no rubber or plastic on the ends.)

Draw a diagram of your hookup when you finish.

ASSIGNMENT SHEET #1

If you could not hook up the bulb and make it light, don't get upset. Just follow the drawings below. They will help show you how to do it.



After you make the bulb light up, make a bell ring. Draw a diagram of the way you hook up a bell to a dry cell.

ASSIGNMENT SHEET #1

If you made the bulb light up and the bell ring, you did so by using electricity. Scientists talk about electricity in different ways. You can think of electricity as trillions of invisible bits of electricity. These bits are called electrons. A dry cell helps send out electrons.

Look at the top of your dry cell. One of the poles is marked with a plus (+) and the other with a minus (-).

Follow the flow of electricity with your fingers. Go from one pole of the dry cell, along the wire, "through" the bulb or bell, and then along the other wire back to the dry cell. Notice that electricity flows in a full circle in a working hookup. This circle or hookup is called a circuit. What three things are needed for a circuit? (Look carefully at the circuit you made. If you need to, read the end of the Introduction again.)

1. _____

2. _____

3. _____

If you want electricity to get from one place to another to do useful work, you use wire. In the same way, when a plumber wants water to get from one part of a house to another, he uses pipes. If a material, like wire, can carry electricity, we say that it is a conductor. The wire you use in these investigations is a conductor of electricity.

But, you may ask, why does rubber cover the wire? The rubber cover protects two things: you and the wire. Your body can conduct electricity. If you held a bare wire, you could be "wired into" the circuit. You wouldn't feel much if the wire had only a small amount of electricity. You WOULD feel it if the wire had a large amount. The cover, therefore, is mainly to protect you. But the cover, which is called insulation, also protects the wire. Insulation stops other things from touching the wire and causing a short circuit. It's called a short circuit because the electricity takes a short cut through the conductor (the thing that touches the wire). The electricity doesn't get a chance to go to whatever was supposed to use it.

The insulation must be taken off the ends of the wire before you can connect the wire. The wire stripper and screw driver are helpful tools. You should take off about 1/2 inch of the insulation before you connect a wire. What would happen if you tried hooking up a circuit without taking the insulation off the ends of the wire?

4. _____

_____

_____

Together with a partner, get these materials: penny, nickel, dime, quarter, rubber comb, piece of plastic, pencil, and strip of paper. You know that electricity can travel through copper metal. You proved this by using a copper wire in a circuit. What other kinds of common materials will carry, or conduct, electricity?

ASSIGNMENT SHEET #1

To find out, set up a circuit to light a light bulb or ring a bell. Then cut one of the wires between the bulbs and the dry cell. First be sure to unhook it. You don't want to cut into a hot wire. Then rehook the two pieces--one to the bulb and one to the dry cell. Now take about 1/2 inch of insulation off the free ends of this cut wire.

Begin your testing by touching the penny to both free ends of the cut wire. Make sure that the wires don't touch each other. Check that the other connections in the circuit are tight. Does the light bulb (or bell) work?

In the same way, test the other objects to see if they are able to conduct electricity. Record your observations on the chart.

Object	Penney	Nickel	Dime	Quarter	Rubber Comb	Plastic	Pencil	Paper	Other
Bulb Lit Up									
Bulb Did Not Light Up									
Electricity Conductor									

ASSIGNMENT SHEET #1

Summary

5. When you hooked up the dry cell to the bulb (or bell) and then cut one of the wires, why didn't the bulb (or bell) work?

_____

_____

_____

6. What materials seem to be the best kind of conductors?

_____

7. Why do wires have insulation?

a. _____

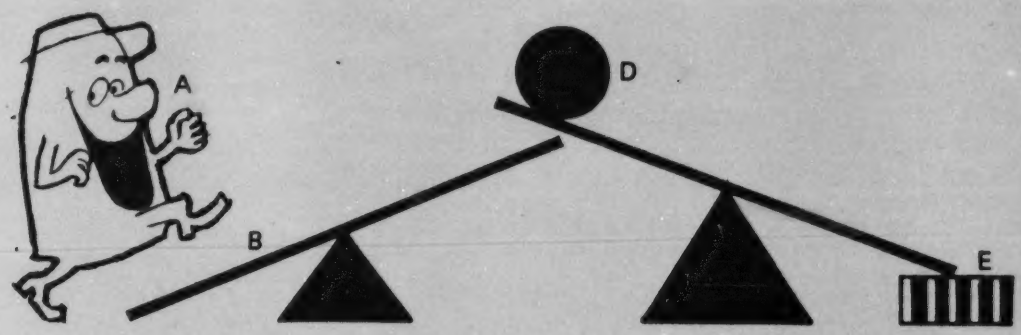
b. _____

SCIENCE IN COMMUNICATION
SYSTEMS ANALYSIS

ASSIGNMENT SHEET #2--SYSTEMS

A subsystem is two objects which directly affect each other. A series of these subsystems is called a system. Our complex society depends on systems to provide many services. Some of these are communications systems which include the telephone system, television system, and the radio system.

A system, then, must be a group of objects which affect each other. The subsystems below are A&B, B&D, D&E.



Example 1

Let's test your creativity. Put together the materials you have received from your teacher to make your own system.

In the space below draw a diagram of the system you plan to build. Indicate the subsystems by labeling them with letters (see Example 1). This diagram may be changed as you are building your system.

1. Student diagram

ASSIGNMENT SHEET #2

2. Your system will be analyzed and evaluated by the following checklist.

	No Points	5 Points	10 Points
Reliability--Ability of your system to work without a breakdown	0%	% of times tried 50-75%	76-100%
Construction--Sturdiness of your system	Constant Repair	Occasional Repair	No Repair
Number of subsystems (NOTE: Your system must have five subsystems.)	0	5-7	7+
Creativity--Unique use of materials	to be evaluated by teacher		

SCIENCE IN COMMUNICATION
SYSTEMS ANALYSIS

ASSIGNMENT SHEET #3--COMMUNICATION SYSTEMS

Use the library to investigate a communications system. Three communication systems are telephone, television, and radio. This report should:

1. Be at least 400 words in length
2. Include a breakdown of subsystems
3. List and describe occupations involved in the system
4. Include a brief history of the system

SCIENCE IN COMMUNICATION
SYSTEMS ANALYSIS

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

1. A source of energy, such as a battery
2. A conductor, such as wire
3. An energy-using device
4. There will not be any current flow. The system will not work.
5. The electron flow was interrupted
6. Metals
7. a. For your protection
   b. Keep other things from touching wire and causing short circuit

Assignment Sheet #2

Evaluation will be made in accordance with the checklist given on the assignment sheet.

Assignment Sheet #3

Each report must contain:

1. 400 words
2. Breakdown and subsystems in system
3. List and description of occupations involved in systems
4. Brjef history of system

SCIENCE IN COMMUNICATION
SYSTEMS ANALYSIS

TEST

1. Match the appropriate term on the right to its definition:

_____a.	Flow of electrons from the negative pole to the positive pole	1.	Insulation
_____b.	Material which can carry electricity	2.	Systems analysis
_____c.	Break in the flow of electrons in a circuit	3.	Circuit
_____d.	Invisible bits of electricity	4.	Conductor
_____e.	Group of subsystems that work together to perform a task	5.	Complete system
_____f.	Material which will not conduct electricity	6.	Electrons
_____g.	The study, identification of parts, testing, and evaluation of a system	7.	Short circuit
_____h.	Two objects which directly affect each other	8.	Subsystem
		9.	Communication system

2. Draw an electrical circuit indicating current flow. Be sure to include the three parts.

3. Identify 5 conductors from the following list by marking an X in the space preceeding each one.

_____a. Copper

_____b. Rubber comb

_____c. Wood

_____d. Penny

_____e. Nickel

_____f. Plastic

_____g. Paper

_____h. Wire

_____i. Dime

_____j. Cloth

4. List four steps in systems analysis.

a.

b.

c.

d.

5. Describe one system of communication, identifying the subsystems. (Evaluated on Assignment Sheet #3)

SCIENCE IN COMMUNICATION
SYSTEMS ANALYSIS

ANSWERS TO TEST

1. a. 3
   b. 4
   c. 7
   d. 6
   e. 5
   f. 1
   g. 2
   h. 8
2. Teacher evaluation of student drawing.
3. a.
   d.
   e.
   h.
   i.
4. a. Study system
   b. Identify subsystems
   c. Test system
   d. Evaluate system
5. Evaluated on assignment sheet.

SCIENCE IN TRANSPORTATION
AIR TRANSPORTATION

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to define the terms associated with flight, name some occupations in air transportation, and apply the major principles of flight to make and fly a paper airplane. This will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms and definitions associated with principles of flight.
2. Label the basic components of an aircraft.
3. Arrange in order the steps in the procedure for reading scientific material.
4. Identify the effects of moving air on high and low pressure.
5. Apply three major principles of flight to make and fly a paper airplane.
6. Demonstrate the ability to:
   a. Pass the Individual Checklist for Model Aircraft Laboratory.
   b. Write a report on occupations related to air transportation.

This unit was written by Jenne Embree and Georgia Pattison in a class at Central State University under the supervision of Dr. Richard Mitchell, Professor of Education.

SCIENCE IN TRANSPORTATION
AIR TRANSPORTATION

SUGGESTED ACTIVITIES

I. Instructor:

A. Provide students with objective sheet.

B. Provide students with information and assignment sheets.

C. Make transparencies.

D. Discuss terminal and specific objectives.

E. Discuss information and assignment sheets.

F. Give test.

II. Student:

A. Read objective sheet.

B. Study information sheets.

C. Complete each assignment sheet.

D. Take test.

INSTRUCTIONAL MATERIALS

I. Provided in this unit:

A. Objectives

B. Information sheet

C. Transparency master: TM 1--Controls of an Airplane

D. Assignment sheets

1. Assignment Sheet #1--Reading Scientific Material
2. Assignment Sheet #2--High and Low Air Pressure
3. Assignment Sheet #3--Applying Principles of Flight
4. Assignment Sheet #4--Model Aircraft Laboratory

5. Assignment Sheet #5--Occupations Related to Air Transportation

D. Answers to assignment sheets

E. Test

F. Answers to test

II. References:

A. *Aviation Education,* "Model Aircraft Laboratory," Washington: Office of General Aviation Affairs/Federal Administration, Department of Transportation, 1972.

B. Tracy, George, Harry Tropp, and Alfred Friedl. *Modern Physical Science.* Dallas, Texas: Holt, Rinehart, and Winston, 1970.

C. Thurber, Walter and Robert Kilburn. *Exploring Physical Science.* New York: Allyn and Bacon, 1970.

D. Oklahoma State Department of Education. *Curriculum Guide for Aerospace Education.* OSDE Curriculum Division, 1970.

SCIENCE IN TRANSPORTATION
AIR TRANSPORTATION

INFORMATION SHEET

I. Terms and definitions associated with principles of flight

A. Lift--Increased speed caused by decrease of air pressure on top of wing causing upward push

B. Thrust--The force exerted through a propeller shaft serving to drive the aircraft ahead

C. Drag--Air resistance on plane which causes it to slow

D. Rudder--Component of aircraft making it turn to the right or left

E. Elevator--Component of aircraft making the back move up or down

F. Aileron--Component of aircraft making it lean to one side

G. Fuselage--Body portion of plane

H. Propeller--Device used to pull aircraft through the air and create thrust

I. Wing--Curved portion of plane causing lift

II. Basic components of an aircraft (Transparency 1)

A. Wing

B. Fuselage

C. Rudder

D. Propeller

E. Aileron

F. Flaps

III. Procedures for reading scientific material (Assignment Sheet #1)

A. Study diagrams

(NOTE: Study Transparency 1. Read the names of the parts. Then try to name them without rereading the labels.)

B. Read all of the boldface headings. In this selection you will find out what three processes will be described

INFORMATION SHEET

C. Read the section under the first heading. Read just one sentence at a time and think about it

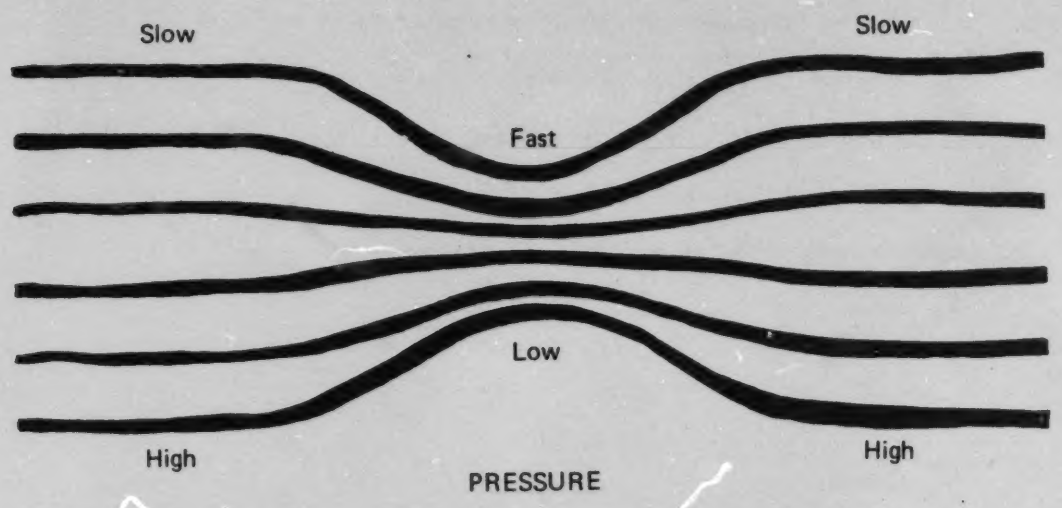
(NOTE: In this unit, look back at the diagrams often to find the part or parts of an airplane mentioned. Try to understand just how these parts work, as described in the sentences. After reading the entire section in this way, try to explain to yourself without looking at the book just how the process takes place.)

D. Read each of the other sections in the same way that you read the first one.

IV. Effects of moving air on high and low pressure (Assignment Sheet #2)

A. Paper will rise only if air pressure is greater underneath it than above it

B. Fluid has lowest pressure when it moves fastest



V. Three major principles of flight

A. Lift--which is created by

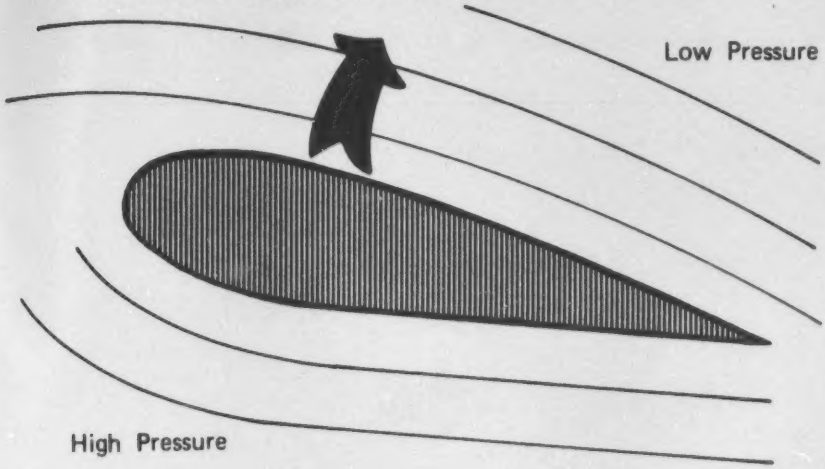
1. High pressure under the wing

(NOTE: Look at an airplane's wing from the edge. You see a shape in which the top of the wing is quite curved. When in flight the position of the wing is set at an angle so that air hits the bottom of the wing. The moving air then creates a high pressure under the wing.)

INFORMATION SHEET

2. Low pressure above the wing

(NOTE: On the upper side of the wing, air is forced to speed up a bit as it is jammed into the narrow space between the curve of the wing and the air above it. It therefore moves faster. This faster motion creates a low pressure above the wing.)



3. Size of the wing

(NOTE: One person could not lift up a car by himself but twenty people could do it. In the same way the air moving across the top and bottom of an airplane wing can hold up only a small amount of weight on a small amount of wing surface, but if the wing is enlarged, each part adds its bit. All together the small lifts add up to a big one, enough to lift the weight of the airplane. This is why the wing of an airplane is large.)

INFORMATION SHEET

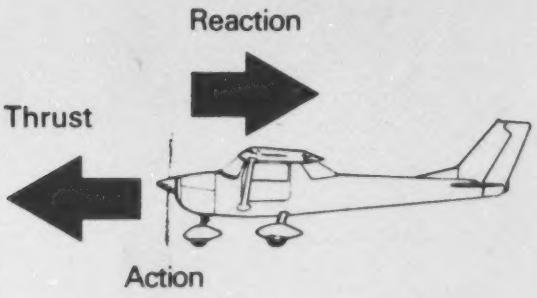
4. Speed of airplane

(NOTE: The lift can be increased by moving faster. The effect of the air in creating lift is then greater. At a certain speed the pressure created by the moving air is enough to raise the airplane into the air.)

B. Thrust--which is caused by (Activity 1, Assignment Sheet #3)

1. Action

2. Reaction

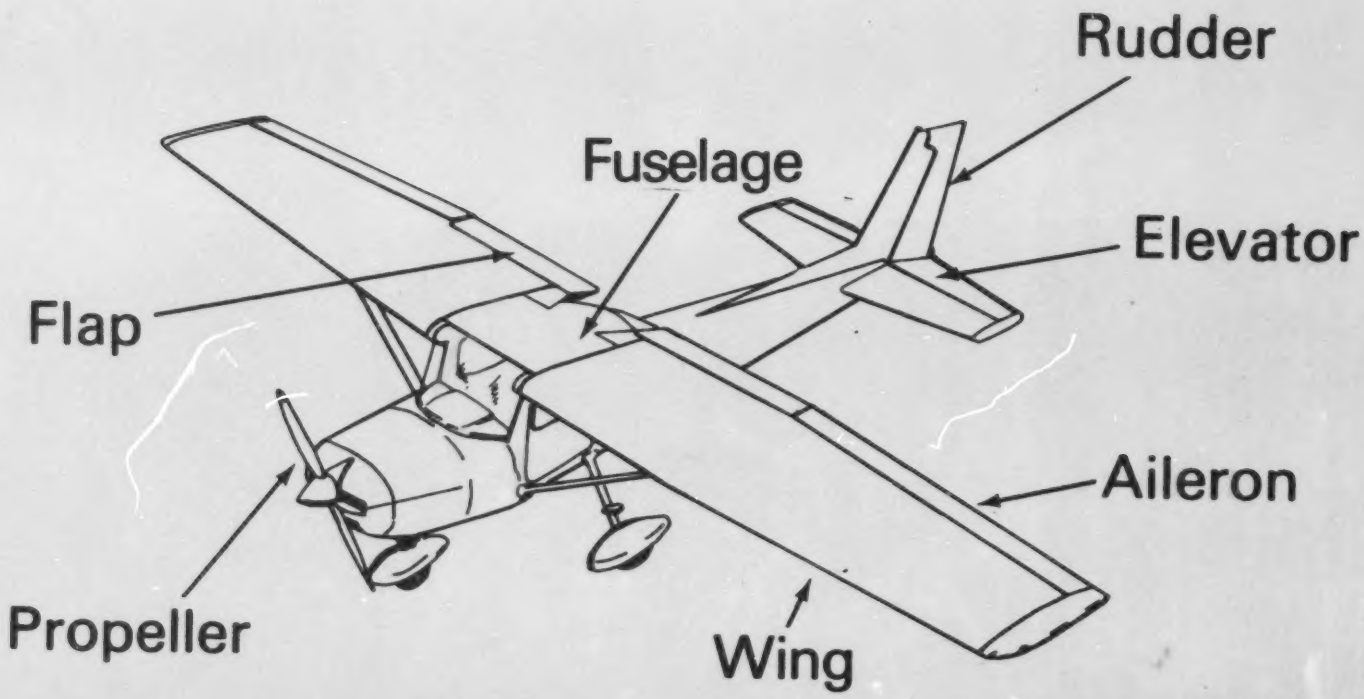


C. Drag, which is affected by

1. Wing size (Activity 2, Assignment Sheet #3)

2. Wing shape (Activity 3, Assignment sheet #3)

Controls of an Airplane



SCIENCE IN TRANSPORTATION
AIR TRANSPORTATION

ASSIGNMENT SHEET #1--READING SCIENTIFIC MATERIAL

1. Reading material

Men who invent or improve airplanes must have a great deal of scientific information. They must know many facts about the air, and they must understand how machinery works. Some of the information which these scientists know so well is explained to you in this section.

WHAT MAKES AN AIRPLANE STAY UP?

There is air all around our earth, up to a height of about 500 miles. This air presses on all objects. It presses equally hard downward, upward, and sideways. Suppose that you could find some way of lessening the downward pressure of the air on this book and at the same time that you could increase the upward pressure. The book would be lifted upward, right out of your hands. The wings of airplanes are shaped to make this lift happen.

The top of each wing is arched, while the bottom is flat. As the plane rolls along the ground, the air rushes over both the top and the bottom of the wing. You can see that the air rushing along the top has a longer way to go to reach the back of the wing because it must travel over the arch. You might expect that this air would take longer in getting to the back, but it doesn't. It gets there at exactly the same time as the air at the bottom. That means it must have moved faster, for it had a longer way to go. This faster movement lessens the air pressure on top of the wing. As the plane races faster and faster along the ground, the air pressure on top of the wing decreases so much that the plane is pushed upward. This upward push is called "lift."

Most of the lift of an airplane wing comes from the arched top of the wing. However, the wing is set at a slight upward slant, so that the air hitting the bottom causes some lift there, too. As long as the plane keeps moving forward fast enough, the lifting force will keep it up in the air.

WHAT MAKES AN AIRPLANE MOVE?

In most small airplanes, one propeller with two or more blades pulls the plane along. Some large airplanes have four or more propellers. If you look at the diagram carefully, you will see that the propeller blades are twisted. To move a plane, you must first start the motor. Then the propeller blades spin, and the twist pushes the air backward. This forces the airplane forward. The forward force pulls the plane along at high speed.

ASSIGNMENT SHEET #1

HOW IS THE POWER PROVIDED?

Power from a gasoline engine causes the propeller to spin. The engine is made up of a number of cylinders. Each cylinder looks like a soup can with one end removed. Inside the cylinder is another "can," called a piston. The piston is just slightly narrower than the cylinder, so the piston can slide back and forth inside the cylinder. The bottom end of the piston is connected to a crankshaft, which is forced to rotate by the sliding of the piston. The propeller is at the end of the crankshaft, so it also spins around.

The piston operates according to a four-stroke cycle. The first stroke, the intake stroke, is a downward movement of the piston that draws a gas-air mixture into the cylinder. The second stroke, the compression stroke, is an upward movement of the piston that squeezes the mixture into the top of the cylinder. At the end of this stroke, the spark plug shoots a spark into the gas-air mixture. The expansion or power stroke follows. The spark causes the compressed gas-air mixture to explode and push the piston downward with great force. The piston then turns the shaft, which turns the propeller which moves the plane. The exhaust stroke is an upward movement to push the burned gases out of the cylinder.

ASSIGNMENT SHEET #1

2. Applying procedure

   a. Drawing an airplane wing

      1) In the space at the bottom of the page draw an airplane wing with the arched top and the slight upward slant of the flat bottom.

      2) Draw a dotted line showing the path traveled by air rushing over the top of the wing.

      3) Draw another dotted line showing the path traveled by air rushing under the wing.

      4) Explain why air pressure is less on top of the wing.

ASSIGNMENT SHEET #1

b. Explaining a process

Explain what happens to make the airplane move, from the time the plane is standing still until it is moving very fast.

1)

2)

3)

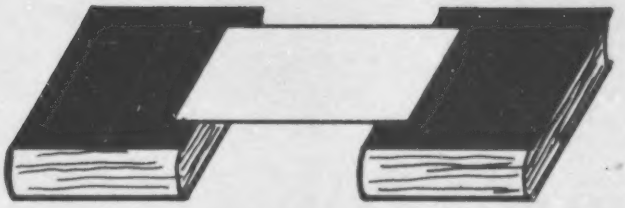
4)

SCIENCE IN TRANSPORTATION
AIR TRANSPORTATION

ASSIGNMENT SHEET #2--HIGH AND LOW AIR PRESSURE

1. Air pressure

Place a card across two books of equal thickness, like this.



Can you blow the card off the books? You think so? Try it. You'll be surprised to find it very difficult to do. In fact, you will probably fail, no matter how hard you blow.

Why does the card act in this strange manner? The answer to this question will help explain how an airplane can fly.

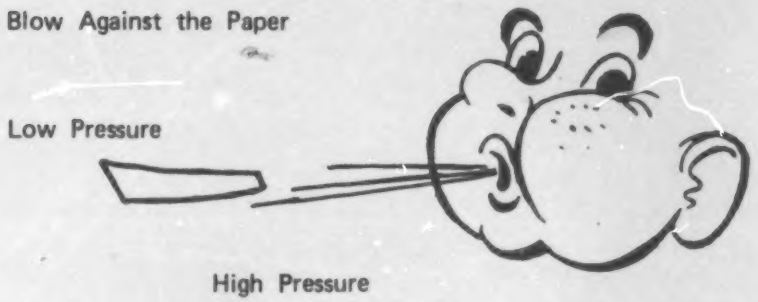
MOVING AIR

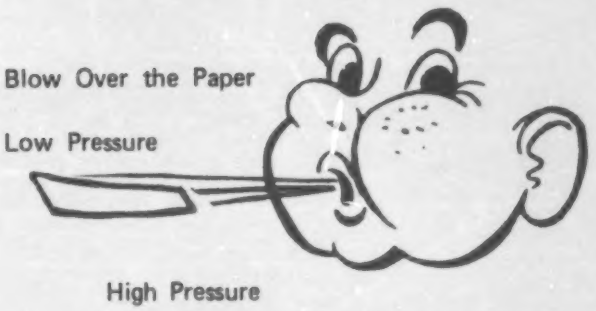
Hold a strip of paper in front of your lips, with the strip hanging downward. Blow against the paper. It is pushed away by the air and rises. The moving air creates a high pressure as it strikes the paper.

A kite remains aloft in this way. The wind creates a high pressure against the broad surface of the kite and pushes it up and back.

ASSIGNMENT SHEET #2

Now blow over the top of the strip, as shown in the drawing. Again the paper rises. The paper would rise only if the pressure is greater underneath the paper than above it. Since the pressure under the paper is not changed in any way, the moving air must have caused a lower pressure on top of the paper.





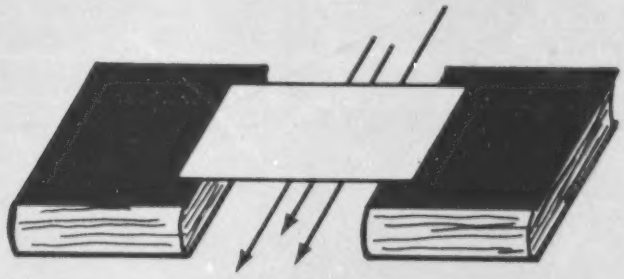
2. High and low air pressure

About 250 years ago, the scientist Bernoulli discovered an important principle that was later used to design airplane wings. According to Bernoulli's principle, a fluid (material that flows) has lowest pressure wherever it moves fastest.

For example, the drawing on your information sheet shows a pipe that narrows down at the center. A liquid flowing slowly in the wide part of the pipe must speed up to get by the narrow part just as the flow of water in the narrow part of a river is more rapid. According to Bernouilli, there will be a low pressure in the narrow part of the pipe where the fluid moves the fastest.

ASSIGNMENT SHEET #2

Let's see how this principle explains why there was difficulty in blowing a card off two books. When you blow under the card, between the books, the fast moving air causes a reduced pressure. The higher pressure above the card then pushes down and makes it cling to the books.



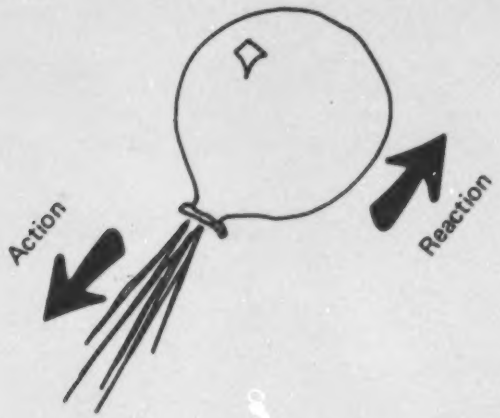
Low Pressure

On the other hand, when you blow down on the card the air also pushes the card against the books. Thus, whether you blow over or under the card it tends to cling to the books.

SCIENCE IN TRANSPORTATION
AIR TRANSPORTATION

ASSIGNMENT SHEET #3--APPLYING PRINCIPLES OF FLIGHT

1. About 250 years ago Sir Isaac Newton explained what makes anything move. In order to move forward a vehicle must push backward against something. To illustrate this blow up a balloon and let go. The action of the air rushing out the back causes a forward reaction that makes the balloon zoom around the room.



(NOTE: The action of the gases moving rapidly backward in a jet airplane causes a reaction that makes the airplane move forward; in a propeller airplane the air is pushed backward by the spinning blades. This backward action on the air causes an equal reaction that makes the airplane move forward. This forward force in a jet or propeller airplane is called thrust.)

2. You have noticed that fast airplanes usually have rather small wings. With such small wings, lift is less and the airplane must move faster before it can take off. It must also land at a higher speed.

With such disadvantages, why are wings of fast airplanes made small? Try the following experiment to find out.

Move a small card against water in the sink or bathtub. First try it with the thin edge of the card moving against the water. Then try it broadside. When the thin edge of the card moves against the water you find that it is much easier to move. There is less resistance to the motion because less water is being pushed out of the way.

ASSIGNMENT SHEET #3

The same thing happens as an airplane moves through the air. The larger the amount of air that must be pushed out of the way by the airplane the larger the resistance of the air. This air resistance in the case of an airplane is called drag because it tends to make the airplane slow down.

The greater the drag the harder the motor must pull to make the airplane move through the air. Thus, to increase the speed of an airplane designers try to cut down on drag.

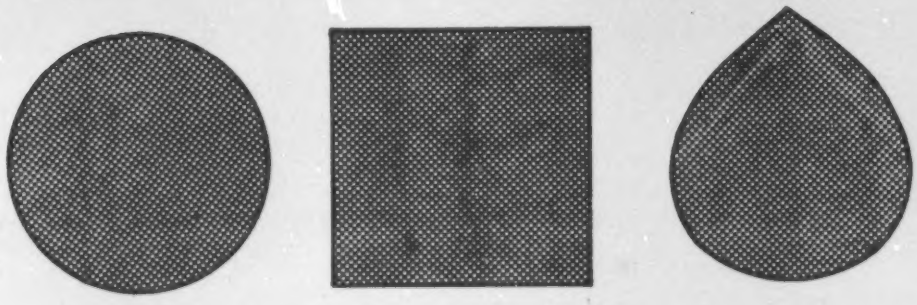
One way to reduce drag is to cut down on the size of parts that face the air. Therefore, the wing is made smaller for fast airplanes.

3. Another way to reduce drag is shown by the following experiment.

Cut three pieces of card, 1 inch wide and 4 inches long. Fold or roll them up to make the shapes shown in the drawing. Place each on a table about 6 inches from the edge and try blowing against each, one at a time.

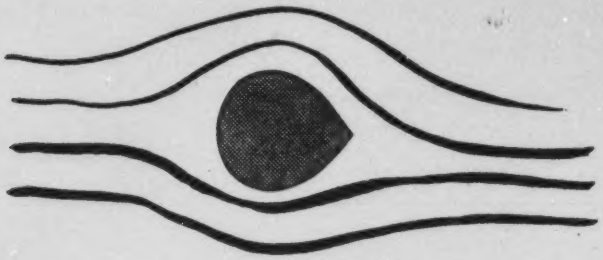
a. Which shape is pushed backward most easily by the air?

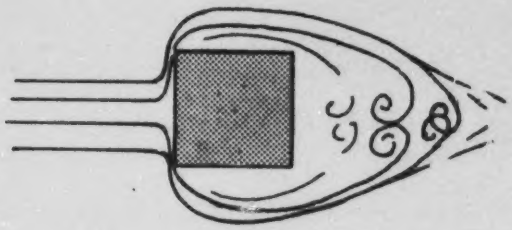
b. Which one requires the most force to make it move?



ASSIGNMENT SHEET #3

You find that a slight force of air makes the square shape move backward. You have to blow much harder to push the teardrop shape.



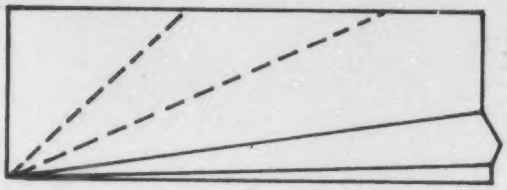


The teardrop shape has less drag than the square one (or even the round one) because the air flows more smoothly around it. This shape is said to be streamlined. Designers of airplanes use large wind tunnels to experiment with different shapes for parts of airplanes. They seek shapes that reduce drag, and therefore increase the speeds of airplanes.

4. Controlling flight

How does a pilot control the flight of his airplane? Let's find out by doing a few experiments.

Make a paper airplane by folding a piece of paper, notebook size, as shown. The heavy paper of a magazine works nicely for such a gliding airplane.



Fold

ASSIGNMENT SHEET #3

Throw the airplane and let it glide. Notice how it goes. Then turn the back ends up slightly, as shown. Now the glider "noses" upward. If the ends are turned up sharply the glider may nose up until it stalls (stops in midair) and then falls nose downward to the ground, just as a real airplane may stall. If your paper airplane moves fast enough it may make a complete circle (called an "inside loop").

Turn the back ends of the glider downward. Now the glider's nose hits the ground, or it may actually land on its back. In an airplane a complete turn of this type in midair is called an "outside loop."

Turn one back end down and the other up. Now the glider rolls over and over, just like the "snap roll" that a real airplane performs.

Your gliding airplane swerves because air striking a turned-up edge pushes against it and thus creates a force that makes it turn.

A real airplane has three main control surfaces. The vertical rudder at the back of the airplane makes the airplane turn right or left.

The pilot controls this with his feet, by pushing left or right on a pivoted bar.

The elevator, also at the back of the airplane, moves up or down as the pilot pushes his stick or wheel backward or forward. When the elevator moves down air hits it from the bottom, pushes the tail up, and makes the airplane nose down. When the stick is pulled back the elevator moves up and the tail is pushed down by the moving air. This makes the airplane nose upward.

Finally, there are two ailerons, one on the back edge of each wing. When one aileron goes up the other always moves down, and vice versa. These make the airplane lean to one side and "bank."

In making a maneuver more than one control must usually be changed. For example, when making a left turn the pilot moves the rudder to the left and at the same time "banks" the airplane by moving the ailerons.

SCIENCE IN TRANSPORTATION
AIR TRANSPORTATION

ASSIGNMENT SHEET #4--MODEL AIRCRAFT LABORATORY

1. Purpose--The Model Aircraft Laboratory provides a controlled laboratory situation in which each individual can demonstrate his knowledge of (1) the scientific principles of flight, (2) the characteristics of aircraft in flight, (3) the in-flight effects of primary control surfaces, and (4) the movements of an aircraft about its three axes. The Aerospace Education Officer (teacher or other designated person) is responsible for conducting the laboratory and he must certify that each participant has successfully completed all of the requirements listed in paragraph 3 of this pamphlet.

2. How to conduct the laboratory

   a. Physical layout

      1) Obtain the use of a large area (room, gymnasium, ramp, etc.) sufficient to allow the flight and observation of paper and balsa gliders

      2) On the floor of the laboratory area, construct (with chalk, tape, or string) a straight line 15 feet long with a 6-foot crossarm at one end, as shown in Figure 1

      3) Provide a table or other suitable flat working surface for use by personnel conducting and participating in the laboratory. The table should be located as shown in Figure 1

   b. Aircraft--Each participant will bring two model aircraft to the laboratory

      1) Aircraft "A" will be a paper aircraft constructed as shown in Figure 2

      2) Aircraft "B" will be an assembled, hand-launched balsa glider

      3) Each participant will print his name on each side of the fuselage of each aircraft for identification purposes

ASSIGNMENT SHEET #4

FIGURE 1

Floor Plan for Model Aircraft Laboratory Flight Area

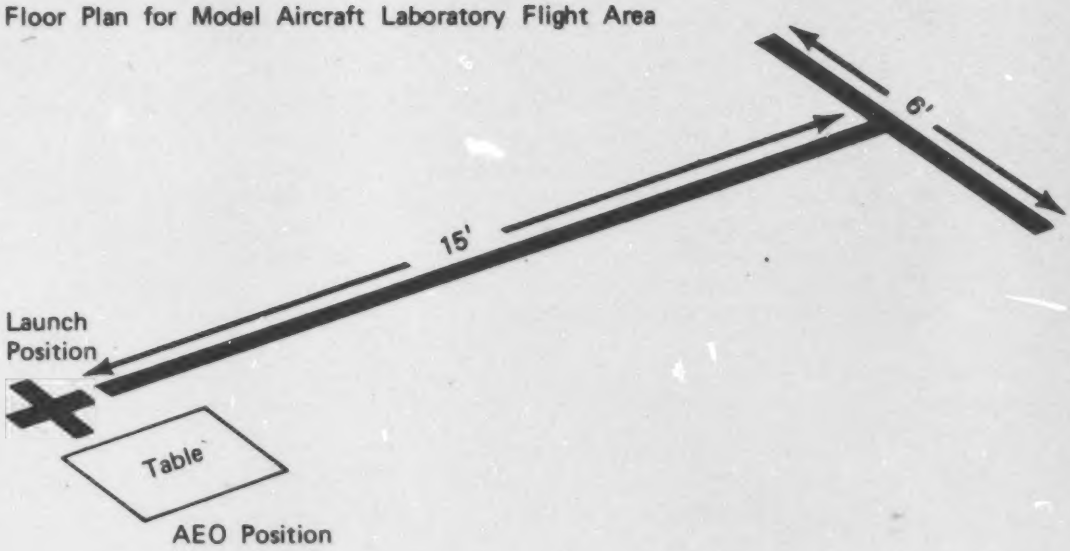
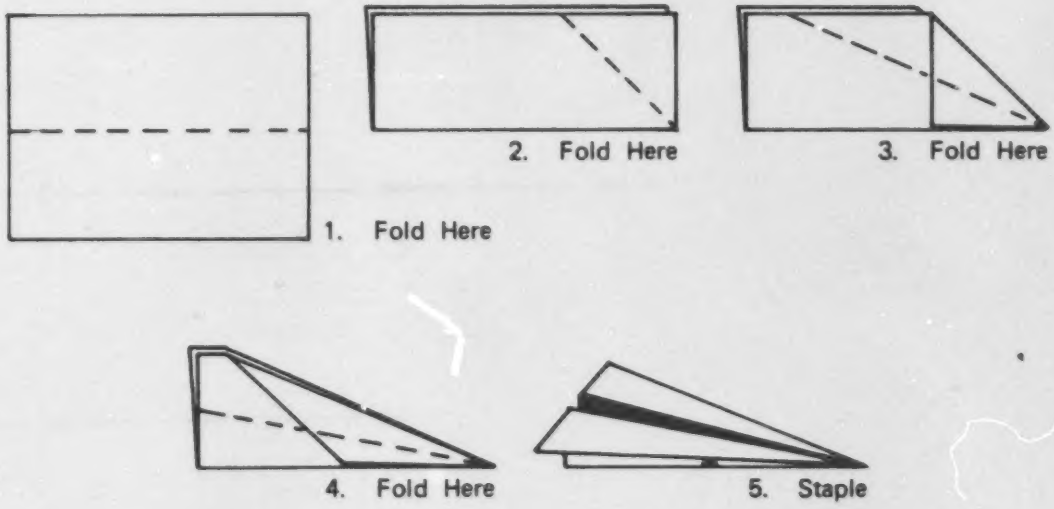


FIGURE 2

Directions for Constructing Paper Model Aircraft "A"



ASSIGNMENT SHEET #4

c. Procedure

1) Each participant will report to the laboratory flight area in the order directed by the Aerospace Education Officer

2) Each participant in the laboratory may not observe the exercise until his own performance has been evaluated

3) Each participant will report to the laboratory with the two aircraft described in paragraph 2b, assembled and ready to fly

4) When called, each participant will approach the laboratory flight area with both aircraft in his left hand. Each cadet will report in a military manner to the assisting cadet officer as follows: "Cadet_____(grade)_____(last name)_____(first name) ready to fly, Sir."

5) The Aerospace Education Officer or his assistant will announce each demonstration to be performed, all of which are contained in the Individual Checklist for the Model Aircraft Laboratory shown in paragraph 3. The participant will then demonstrate his knowledge, understanding, and/or abilities in each category of participation.

6) The Aerospace Education Officer will observe each participant's performance and record on an individual checklist a "P" (for pass) or an "F" (for failure) in each step. The participant may progress from one checklist item to the next without achieving success; however, each item must be performed successfully before credit for satisfactory completion of the laboratory can be given

7) At the end of the checklist, the participant will be graded by the Aerospace Education Officer as a success or failure in the laboratory

If performance of any of the checklist items has been unsatisfactory, the areas of failure will be identified. An opportunity will be provided, outside the regular meeting schedule, for each individual with unsatisfactory ratings to satisfactorily complete the exercise. Once any item on the checklist is successfully completed, that item does not have to be reaccomplished.

8) Upon completion of the laboratory period, the Aerospace Education Officer will report to the class the results of the laboratory and advise each person of the time and place scheduled for a re-examination of individuals with unsatisfactory ratings

ASSIGNMENT SHEET #4

3. Checklist to be completed--The Aeorspace Education Officer will assure completion of the following checklist for each individual participating in the Model Aircraft Laboratory as follows: (1) Announce each checklist item in numbered order, (2) observe and evaluate the participant's performance on that item, and (3) enter an "X" in the appropriate block to denote pass (P) or failure (F).

ASSIGNMENT SHEET #4

INDIVIDUAL CHECKLIST FOR MODEL AIRCRAFT LABORATORY

PARTICIPANT'S NAME DATE PASSED AEO'S INITIALS

1. Aircraft nomenclature. Identify each of the following items by pointing to the correct part on the model.

	Aircraft "A"	Aircraft "B"
TAIL	1. ___P ___F	7. ___P ___F
WINGS	2. ___P ___F	8. ___P ___F
FUSELAGE	3. ___P ___F	9. ___P ___F
ELEVATORS	4. ___P ___F	10. ___P ___F
AILERONS	5. ___P ___F	11. ___P ___F
RUDDER	6. ___P ___F	12. ___P ___F

2. Demonstrations. Accomplish the following items without launching the model:

   a. Name each axis of an aircraft in flight and show the location of that axis by placing the fingertips at the extreme ends of the axis.

LONGITUDINAL	13. ___P ___F
VERTICAL	14. ___P ___F
LATERAL	15. ___P ___F

   b. Name and identify each of the primary control surfaces on the model and describe the effect of each in flight:

ELEVATORS	16. ___P ___F
AILERONS	17. ___P ___F
RUDDER	18. ___P ___F

   c. Demonstrate the following maneuvers:

CLIMB	19. ___P ___F
DIVE	20. ___P ___F
ROLL	21. ___P ___F
CLIMB-STALL-DIVE	22. ___P ___F
CLIMBING TURN	23. ___P ___F
DIVING TURN	24. ___P ___F
LOOP	25. ___P ___F
SPIN	26. ___P ___F
SLOW ROLL	27. ___P ___F

3. Flight Performance. Facing the crossarm from the launch position of the flight area (See Figure 1) launch the model to perform the maneuvers listed below. Three launches are allowable for each maneuver.

GLIDE STRAIGHT AHEAD A MINIMUM OF 15 FEET STAYING WITHIN THE 6-FOOT CORRIDOR ABOVE THE CROSSARM	28. ___P ___F
CLIMB-STALL-DIVE	29. ___P ___F
NOSE-HIGH SLOW FLIGHT	30. ___P ___F
GLIDING SPIRAL TO LEFT	31. ___P ___F
GLIDING SPIRAL TO RIGHT	32. ___P ___F

SCIENCE IN TRANSPORTATION
AIR TRANSPORTATION

ASSIGNMENT SHEET #5–OCCUPATIONS RELATED TO AIR TRANSPORTATION

Write a report on occupations of air travel. The following should be included in the report:

1. Six or more occupations discussed
2. 400 or more words in length
3. Duties of each worker
4. Qualifications for occupations

(NOTE: Some suggested occupations are:

a. Stewardess - Steward
b. Pilot
c. Navigator
d. Mechanic
e. Air Traffic Controller
f. Reservation/Ticket Agent
g. Porter
h. Airport Manager
i. Cargo Agent
j. Plotting Board Operator.)

SCIENCE IN TRANSPORTATION
AIR TRANSPORTATION

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

2. a. 1), 2), and 3) are self explanatory

   4) The air moves faster and lessens air pressure on top of the wing

   b. 1) Motor turned on

   2) Propeller blades begin to spin, pushing air backward

   3) This forces airplane forward

   4) Forward force pulls plane along at high speed

Assignment Sheet #2--Evaluated to the satisfaction of the instructor

Assignment Sheet #3

1. Evaluated to the satisfaction of the instructor
2. Evaluated to the satisfaction of the instructor
3. a. Square shape

   b. Teardrop shape

4. Evaluated to the satisfaction of the instructor

Assignment Sheet #4--Completion of checklist at end of activity

Assignment Sheet #5--Answers will vary

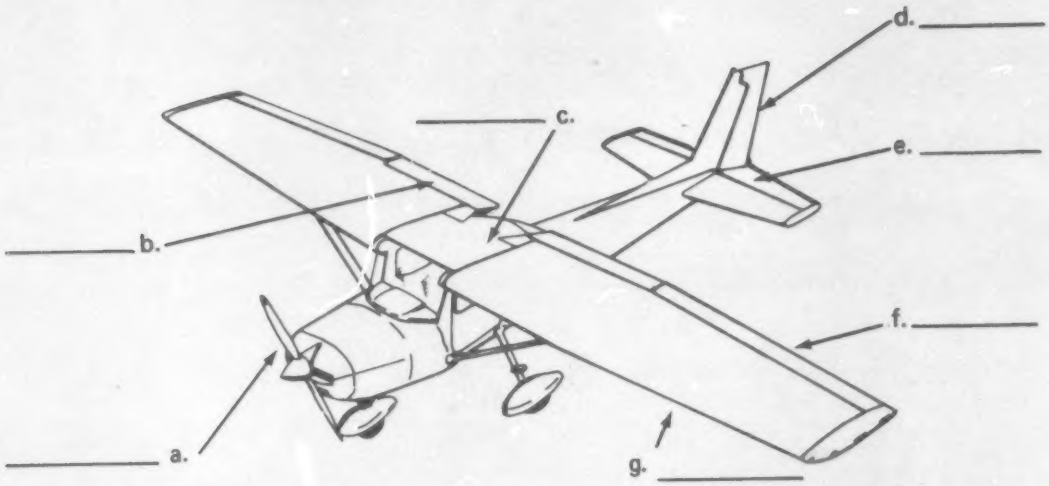
SCIENCE IN TRANSPORTATION
AIR TRANSPORTATION

TEST

1. Match terms on the left to the correct definition.

_____a. Air resistance on plane which causes it to slow	1. Lift
_____b. Component of aircraft making it lean to one side	2. Thrust
_____c. The force exerted through a propeller shaft serving to drive the aircraft ahead	3. Drag
_____d. Body portion of plane	4. Rudder
_____e. Component of aircraft making the back move up or down	5. Elevator
_____f. Device used to pull aircraft through the air and create thrust	6. Aileron
_____g. Curved portion of plane causing lift	7. Fuselage
_____h. Increased speed caused by decrease of air pressure on top of wing causing upward push	8. Propeller
_____i. Component of aircraft making it turn to the right or left	9. Wing

2. Label basic components of an airplane.



3. Arrange in order the following steps in the procedure for reading scientific material. Place a 1 before Step 1, a 2 before Step 2, etc.

_____a. Read all the boldface headings

_____b. Read each of the other sections in the same way that you read the first one

_____c. Read the section under the first heading

_____d. Study the diagrams

4. Identify the effects of moving air on high and low pressure by selecting the correct answer in the following questions.

_____a. Paper will rise only if

1) Air pressure is greater above it

2) Air pressure is greater underneath it

3) Air pressure is the same above and below it

_____b. Fluid has lowest pressure when it

1) Moves fastest

2) Moves slowest

3) Stands still

5. Apply three major principles of flight to make and fly a paper airplane

   (NOTE: Completed on Assignment Sheet #3.)

6. Demonstrate the ability to:

   a. Pass the Individual Checklist for Model Aircraft Laboratory.

   b. Write a report on occupations related to air transportation.

      (NOTE: These activities should have been completed on Assignment Sheets #4 and #5.)

SCIENCE IN TRANSPORTATION
AIR TRANSPORTATION

ANSWERS TO TEST

1. a. 3
   b. 6
   c. 2
   d. 7
   e. 5
   f. 8
   g. 9
   h. 1
   i. 4
2. a. Propeller
   b. Flap
   c. Fuselage
   d. Rudder
   e. Elevator
   f. Aileron
   g. Wing
3. a. 2
   b. 4
   c. 3
   d. 1
4. a. 2
   b. 1
5. Evaluated on Assignment Sheet #3.
6. Evaluated on Assignment Sheets #4 and #5.

SCIENCE IN HEALTH OCCUPATIONS
MEDICAL ASSISTANT

TERMINAL OBJECTIVE

After completion of this unit, the student will be familiar with the duties of a medical assistant as performed in a physician's office. The student will accurately perform and record the results of simple screening examinations. This will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match medical terms with definitions.
2. Name three major responsibilities of a medical assistant.
3. Name four types of examination techniques.
4. Discuss orally or in writing factors which increase or decrease body temperature, pulse, and respiration.
5. Demonstrate the ability to:
   a. Take a pulse.
   b. Determine body temperature.
   c. Observe respiration rate.
   d. Test for blood type.
   e. Complete a screening examination.

This unit was written by John Shaffer in a class at Central State University under the supervision of Dr. Richard Mitchell, Professor of Education.

SCIENCE IN HEALTH OCCUPATIONS
MEDICAL ASSISTANT

SUGGESTED ACTIVITIES

I. Instructor:

A. Provide students with objective sheet.

B. Provide students with information and assignment sheets.

C. Make transparencies.

D. Discuss terminal and specific objectives.

E. Discuss information and assignment sheets.

F. Discuss and demonstrate lab procedures.

G. Provide necessary lab instruments.

H. Give test.

II. Student:

A. Read objective sheet.

B. Study information sheet.

C. Complete each assignment sheet.

D. Take test.

INSTRUCTIONAL MATERIALS

I. Provided in this unit:

A. Objectives

B. Information sheet

C. Transparency masters

1. TM 1--Pulse Rates

2. TM 2--Clinical Thermometer

3. TM 3--Rates of Normal Respiration

4. TM 4--Blood Typing

D. Assignment sheets

1. Assignment Sheet #1--Take a Pulse

2. Assignment Sheet #2--Determine Body Temperature

3. Assignment Sheet #3--Observe Respiration Rate

4. Assignment Sheet #4--Test for Blood Type

5. Assignment Sheet #5--Complete a Screening Examination

E. Answers to assignment sheets

F. Test

G. Answers to test

II. References:

A. Lawton, Murray M. and Donald F. Foy. *A Textbook for Medical Assistants.* St. Louis, Missouri: The C. V. Mosley Company, 1971.

B. Smallwood, William L. *Life Science.* New York: McGraw-Hill Book Company, 1973.

C. Beck, William S. *Human Design.* New York: Harcourt, Brace, Jovanovich, Inc., 1971.

SCIENCE IN HEALTH OCCUPATIONS
MEDICAL ASSISTANT

INFORMATION SHEET

I. Medical terms and definitions

A. Pulse--Indicates the rate the blood vessels are expanding and contracting

B. Temperature--Balance maintained between the heat produced and the heat lost by the body

C. Clinical thermometer--Small glass tube containing a column of mercury; used to measure body temperature

D. Respiration--One breath taken in and breathed out

E. Inhale--Air breathed into the lungs

F. Exhale--Carbon dioxide breathed out of the lungs

G. Lancet--Device used to puncture the skin

H. Antiserum--Chemicals used to determine blood type

II. Major responsibilities of a medical assistant

A. Maintains examination records

B. Assists physician during examinations

C. Performs screening examinations

III. Types of examination techniques

A. Pulse (Transparency 1)--The pulse can be found by placing two fingers over the arteries in the wrist

B. Body temperature (Transparency 2)--A clinical thermometer is used to measure the body temperature

(NOTE: Normal body temperature is 98.6° F.)

C. Respiration rate (Transparency 3)--Can be counted by watching the rise and fall of the chest

D. Blood and blood types (Transparency 4)

1. Type A 39% of population in United States

2. Type B 13% of population in United States
3. Type AB 5% of population in United States
4. Type O 42% of population in United States

IV. Factors that increase or decrease pulse, temperature, and respiration

A. Pulse

1. Increase--Drugs, diseases, and high body temperature
2. Decrease--Certain illnesses and diseases

B. Body temperature

1. Increase--Disease, worry, fear or excitement
2. Decrease--Shock, collapse or bleeding

C. Respiration rate

1. Increase--Excitement, nervousness, and strong emotion
2. Decrease--Certain diseases or injuries to the brain

Pulse Rates

60 and Below	SLOW
60-80	NORMAL (MEN AND WOMEN)
80-100	MODERATE INCREASE
100-120	QUICK
120-140	RAPID
140 and Above	ACCELERATED

Clinical Thermometer

100

Rates of Normal Respiration

14-18	Respirations In One Minute In Men
18-20	Respirations In One Minute In Women
20-26	Respirations In One Minute In Children
30-38	Respirations In One Minute In Infants

Blood Typing

Type	Anti Serum A	Anti Serum B
A		
B		
AB		
O		

SCIENCE IN HEALTH OCCUPATIONS
MEDICAL ASSISTANT

ASSIGNMENT SHEET #1--TAKE A PULSE

In order to get an accurate pulse rate, you must be relaxed. Do not take a pulse immediately after exercise.

1. Allow the left arm and hand to be in a comfortable position.
2. Gently apply the first two fingers of your right hand to the wrist, just below the thumb.

   (NOTE: Do not use your thumb because inaccurate pulsations may be recorded.)
3. While observing a watch, count the number of pulsations occurring in one minute.
4. After a brief rest, check the pulse again for any great difference in number of pulsations.

After determining your pulse rate under relaxed conditions, perform two minutes of mild exercise by walking up and down a stairway. Again, determine your pulse rate.

Questions:

1. What is the range of the normal pulse rate for men and women?
2. What was your pulse rate during relaxation?
3. How much did the pulse rate increase after mild exercise?

SCIENCE IN HEALTH OCCUPATIONS
MEDICAL ASSISTANT

ASSIGNMENT SHEET #2--DETERMINE BODY TEMPERATURE

Using a clinical thermometer, measure your body temperature. Care must be taken that the thermometer has been disinfected by soaking it in a solution of 70% alcohol for ten minutes.

1. Shake the thermometer until it registers 96° or below.
2. Place the thermometer under the tongue with the end coming out at the corner of the mouth.
3. Leave the thermometer under the tongue for at least two minutes.
4. Read the temperature.
5. Should the temperature be too high or too low for no apparent reason, shake the thermometer again and measure the temperature.
6. After using the thermometer, clean it first in soap and water, then in clean water, and place it in a 70% alcohol solution.

Questions:

1. What was your body temperature?
2. How does it compare with the normal body temperature?
3. What causes body temperature?

SCIENCE IN HEALTH OCCUPATIONS
MEDICAL ASSISTANT

ASSIGNMENT SHEET #3--OBSERVE RESPIRATION RATE

Since the respiration rate can be controlled, this assignment must be performed with a laboratory partner. A watch with a second hand and pencil and paper are required.

1. Measuring the respiration rate while at rest

   a. Have your lab partner in a sitting position.

   b. The number of respirations are counted by watching the rise and fall of the chest for one minute.

   c. Should the respirations be irregular repeat the procedures three times to be sure of correctness.

   d. Record the respiration rate.

   e. Now change places with your lab partner, repeat the procedures in determining respiration rate, and record them.

2. Measuring the respiration rate after completing a mild form of exercise

   (NOTE: This exercise can be walking up and down stairs or performing push-ups or sit-ups for one minute.)

   a. Upon completion of the mild exercise, again measure and record the respiration rate of your partner.

   b. Change places with your partner and have your respiration rate measured and recorded after completing the same form of exercise.

Questions:

1. How does your respiration rate before exercise compare with the "Normal Respiration Rate"?

2. What was your respiration rate after the mild exercise?

3. Why did your respiration rate increase?

SCIENCE IN HEALTH OCCUPATIONS
MEDICAL ASSISTANT

ASSIGNMENT SHEET #4--TEST FOR BLOOD TYPE

Materials needed for this assignment are lancet, a clean slide, antiserum A and antiserum B, toothpicks, cotton balls, 70% alcohol, and clinical thermometers.

1. Draw two circles on a glass slide.
2. Label one as antiserum A and the other as antiserum B.
3. Place one drop of antiserum A in the A circle and one drop of antiserum B in the B circle.
4. Wash your hands; then wipe off the tip of the middle finger with cotton soaked in alcohol.
5. Place the thumb next to this finger and prick the tip of your finger with a lancet.

   (NOTE: The puncture in the finger should be parallel to the lines in the skin.)
6. Wipe the first drop of blood off with a piece of dry cotton.
7. Using a toothpick, place a drop of blood on the slide labeled antiserum A.
8. With another toothpick, place a second drop of blood on the slide labeled antiserum B.
9. Place cotton ball soaked with alcohol over the puncture.
10. Observe the slide and determine the blood type from the list below

    Blood clots in circle anti-A = Blood Type A
    Blood clots in circle anti-B = Blood Type B
    Blood clots in circles anti-A and B = Blood Type AB
    Blood does not clot in either = Blood Type O

Questions:

1. What is your blood type?
2. What percent of the population has this type of blood?
3. Can all four types of blood be identified by using only antiserum A? Explain.

SCIENCE IN HEALTH OCCUPATIONS
MEDICAL ASSISTANT

ASSIGNMENT SHEET #5--COMPLETE A SCREENING EXAMINATION

Now that you have learned the procedures for simple screening examinations, it's time to put your knowledge to work.

Perform the necessary tests on your lab partner that are required on the Screening Examination Form listed below.

Be kind and courteous to your lab partner. He is your patient.

SCREENING EXAMINATION FORM

PATIENT'S NAME _____ AGE _____ SEX ____

ADDRESS _____

PULSE: AT REST _____

AFTER EXERCISE _____

RESPIRATION: AT REST _____

AFTER EXERCISE _____

TEMPERATURE: _____ _____

BLOOD TYPE: A B AB O

REMARKS: _____

_____

_____

MEDICAL ASSISTANT EXAMINER

_____

SCIENCE IN HEALTH OCCUPATIONS
MEDICAL ASSISTANT

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

1. 60-80 beats per minute
2. Answers will varv
3. Answers depend on pulse rate before and after exercise

Assignment Sheet #2

1. Answers will vary
2. Answers may vary from normal temperature of 98.6°F.
3. The balance between the amount of heat produced and the heat lost in a person

Assignment Sheet #3

1. Answers will vary with each student
2. Answers will vary but will show a marked increase
3. The cells of the body require more oxygen in order to perform any amount of exercise

Assignment Sheet #4

1. Answers will be either A, B, AB, or O
2. A = 39% of population
   B = 13% of population
   AB = 5% of population
   O = 42% of population
3. No. Antiserum A would only definitely identify blood type A

Assignment Sheet #5–Evaluated to the satisfaction of the instructor

SCIENCE IN HEALTH OCCUPATIONS
MEDICAL ASSISTANT

TEST

1. Match terms on the right to the correct definitions on the left.

_____a.	Device used to puncture the skin	1.	Pulse
_____b.	One breath taken in and breathed out	2.	Temperature
_____c.	Chemicals used to determine blood type	3.	Clinical thermometer
_____d.	Balance maintained between the heat produced and the heat lost by the body	4.	Respiration
_____e.	Carbon dioxide breathed out of the lungs	5.	Inhale
_____f.	Small glass tube containing a column of mercury that is used to measure body temperature	6.	Exhale
_____g.	Indicates the rate blood vessels are expanding and contracting	7.	Lancet
_____h.	Air breathed into the lungs	8.	Antiserum

2. Name three major responsibilities of a medical assistant.

   a.

   b.

   c.

3. Name the four types of examination techniques.

   a.

   b.

   c.

   d.

4. Discuss orally or in writing the factors that would increase or decrease body temperature, pulse and respiration.

5. Demonstrate the ability to:

   a. Take a pulse.

   b. Determine body temperature.

   c. Observe respiration rate.

   d. Test for blood type.

   e. Complete a screening examination.

   (NOTE: These activities should have been completed in the assignment sheets.)

SCIENCE IN HEALTH OCCUPATIONS
MEDICAL ASSISTANT

ANSWERS TO TEST

1. a. 7
   b. 4
   c. 8
   d. 2
   e. 6
   f. 3
   g. 1
   h. 5
2. a. Maintains examination records
   b. Assists physician during examinations
   c. Performs screening examinations
3. The following may be listed in any order.
   a. Respiration rate
   b. Body temperature
   c. Pulse
   d. Blood types
4. Discussed orally or in writing to the satisfaction of the instructor.
5. Performance skills will be evaluated to the satisfaction of the instructor.

SCIENCE IN AGRIBUSINESS AND NATURAL RESOURCES
ENERGY FROM NATURAL RESOURCES

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to recognize different natural resources used for energy in technology and industry, match jobs related to natural resources, tell how an energy shortage can affect business, and construct an energy source. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms and definitions associated with power and energy.
2. List the natural resource forms of energy.
3. Describe transformation of energy.
4. Write the Law of the Conservation of Energy.
5. Match four job titles pertaining to natural resources with their job description.
6. List three effects on business due to a natural resources energy shortage.
7. Demonstrate the ability to:
   a. Show a chemical energy source.
   b. Construct a steam turbine.

This unit was written by Linda Scott in a class at Central State University under the supervision of Dr. Richard Mitchell, Professor of Education.

SCIENCE IN AGRIBUSINESS AND NATURAL RESOURCES
ENERGY FROM NATURAL RESOURCES

SUGGESTED ACTIVITIES

I. Instructor:

A. Provide students with objective sheet.

B. Provide students with information, job, and assignment sheets.

C. Discuss terminal and specific objectives.

D. Discuss information and assignment sheets.

E. Explain or demonstrate energy sources.

F. Discuss job descriptions in relation to energy sources jobs.

G. Discuss effects on business due to natural resources energy shortages.

H. Demonstrate and discuss procedures outlined in the job sheets.

I. Give test.

II. Student:

A. Read objective sheet.

B. Study information sheet.

C. Observe demonstration on energy sources.

D. Complete assignment sheets and turn in to instructor.

E. Research the businesses in your community and determine which ones use the most natural resources.

F. Demonstrate the ability to accomplish the procedures outlined in the job sheets.

G. Take test.

INSTRUCTIONAL MATERIALS

I. Provided in this unit:

A. Objectives

B. Information sheet

C. Assignment sheet--Assignment Sheet #1--Businesses Which Use Natural Resources

D. Answers to assignment sheet

E. Job Sheets

1. Job Sheet #1--Vinegar Bottle Experiment

2. Job Sheet #2--A Steam Turbine

F. Answers to job sheets

G. Test

H. Answers to test

II. References:

A. Larber, Nelson. *Science Activities*. Dubuque, Iowa: WMC Brown Company.

B. Feingold, Norman and Sol Swerdloff. *Occupations and Careers*. New York: McGraw Hill (Webster Division), 1969.

C. *Career Desk Top Kit*, Careers Inc., Largo, Florida: 1971.

SCIENCE IN AGRIBUSINESS AND NATURAL RESOURCES
ENERGY FROM NATURAL RESOURCES

INFORMATION SHEET

I. Terms and definitions

A. Energy--Ability to do work

B. Work--Force through a distance

C. Force--A push or pull on something; any force that produces motion or that prevents motion

(NOTE: A force puts an object in motion.)

D. Motion--Movement, such as a moving object

(NOTE: Work accomplished--When a force acts through a distance)

II. Natural resource forms of energy

A. Petroleum

B. Coal

C. Chemical

D. Mechanical

1. Wind

2. Water

E. Solar

III. Transformation of energy--One form of energy changed into another form of energy; change known as the transformation of energy

Example: Running water (mechanical energy) turns the turbines of a hydroelectric power plant. The turbine spins and the generator produces electricity. Mechanical energy, in turn, becomes electricity. Electrical energy runs through the burners of an electric stove. In this instance, electrical energy is transformed into heat energy. Chemical energy is changed into light and heat energy when the wood in a fireplace burns. A burning candle transforms chemical energy into both heat and light.

INFORMATION SHEET

A. Machines and devices could not operate without transformation of energy

B. No energy is lost when one form is changed into another form; there is no loss of energy when electrical energy is converted to heat energy

C. The heat energy which an electric stove gives off equals the amount of energy which the electricity puts into it

D. Energy cannot be destroyed; neither can it be created

IV. Law of Conservation of Energy--Energy can neither be created nor destroyed but may be converted from one form to another

Example: You may question whether the mechanical energy of a hammer doesn't somehow disappear, but feel the head of the nail which the hammer struck. The nail head is hot. Some of the mechanical energy of the hammer has been converted into heat energy.

V. Job titles and their descriptions pertaining to natural resources

A. Mining engineers--Aid in searching for mineral deposits; determine whether deposits exist and are rich enough to mine; determine position of mine, methods of transportation to surface, and extraction; are in charge of safety, equipment, personnel, and mining operations

B. Petroleum engineers--Plan and supervise drilling for oil and natural gas; help prepare drilling site; select method for drilling; direct workers in installing drilling rig and machinery; advise drilling personnel on technical matters; select method for getting oil and gas to surface; control rate of production

C. Geophysicists--Study earth's physical characteristics, such as its electric, magnetic, and gravitational fields, the earth's interior heat flow and vibrations, and solar radiation; use complex precision measuring instruments and electronic computers to record and process data; search for oil and mineral deposits; track satellites; probe oceans

D. Geologists--Identify fossils; study history and composition of rock, physical and chemical properties of mineral deposits, form of earth's surface and events that change it; locate and develop mineral resources sites for bridge foundations, tunnels, and wells

VI. Effects on business due to a natural resource energy shortage

A. Transportation or shipping--Personnel and/or materials

B. Production of materials--Plastics, synthetics, paper, etc.

C. Materials used in production or business--Steel for construction

D. Price increase--All petroleum products and food

E. Fuel for machinery--Propane, oil, diesel fuel

F. Heating and cooling for plants or factories--Personal heat for homes, also

SCIENCE IN AGRIBUSINESS AND NATURAL RESOURCES
ENERGY FROM NATURAL RESOURCES

ASSIGNMENT SHEET #1--BUSINESSES WHICH USE NATURAL RESOURCES

Research the businesses in the community and the amount and type of natural resources they use for energy in production.

List the four businesses which use the most natural resources and give the type of use.

1.

2.

3.

4.

SCIENCE IN AGRIBUSINESS AND NATURAL RESOURCES
ENERGY FROM NATURAL RESOURCES

ANSWERS TO ASSIGNMENT SHEET

Assignment Sheet #1--Evaluated to the satisfaction of the instructor but answers should be relevant to the local community.

SCIENCE IN AGRIBUSINESS AND NATURAL RESOURCES
ENERGY FROM NATURAL RESOURCES

JOB SHEET #1--VINEGAR BOTTLE EXPERIMENT

I. Materials needed

A. Soft drink bottle

B. Cork or rubber stopper

C. Vinegar water

D. Baking soda

E. Paper napkins

F. Spoon and cup for measuring

G. Thread

II. Procedure--See illustration on following page

(NOTE: This assignment sheet could be conducted as a teacher demonstration.)

A. Fill bottle about one-third full of vinegar solution (one tbsp. vinegar to one cup of water)

B. Wrap one teaspoonful of baking soda in a napkin

C. Tie thread around napkin and suspend by fitting cork to neck of bottle

D. Close bottle fairly tightly

E. When generator is set to use, invert bottle momentarily; the solution will soften the napkin and the soda will be released to drop into the vinegar solution

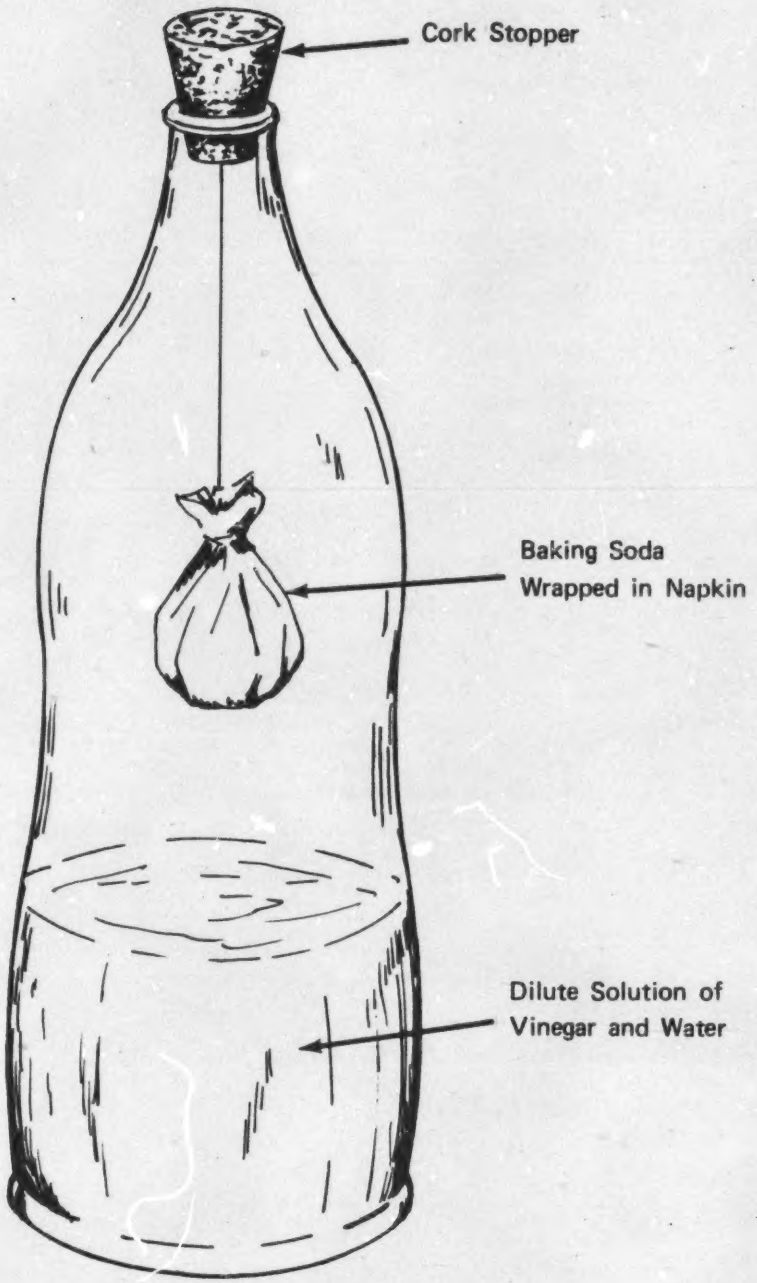
F. Point the top of the bottle toward the ceiling or toward a solid wall. (Be careful not to point it toward anything which might break or anyone who might be injured. Sometimes the cork pops out with great force.)

G. Keep other class members at least six feet from bottle

H. Explain results

I. Question--Why do we wrap the baking soda in a paper napkin?

JOB SHEET #1


Cork Stopper
Baking Soda
Wrapped in Napkin
Dilute Solution of
Vinegar and Water

SCIENCE IN AGRIBUSINESS AND NATURAL RESOURCES
ENERGY FROM NATURAL RESOURCES

JOB SHEET #2--A STEAM TURBINE

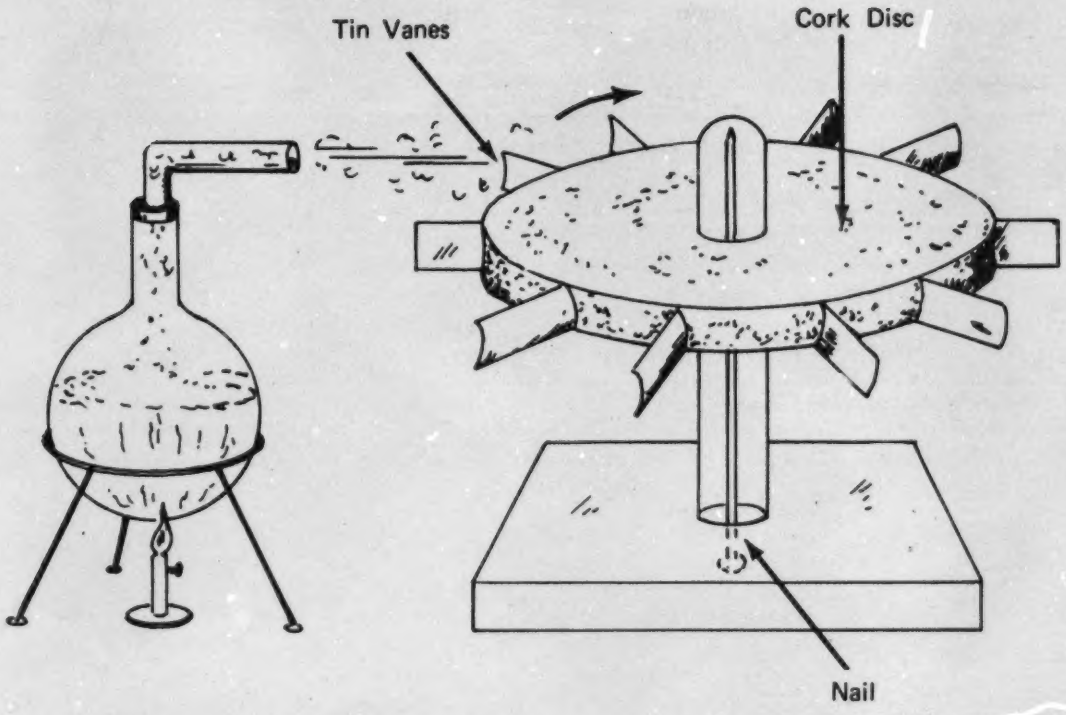
I. Materials needed

- A. Three-inch cork disc
- B. Eight strips of tin (1/2 inch by 1 1/2 inches)
- C. Flat board (4-inch square)
- D. Long nail
- E. Glass test tube
- F. Gas burner
- G. Glass tube bent at right angles
- H. Rubber cork
- I. Glass bottle (Pyrex)
- J. Tripod

II. Procedure

- A. Assemble the materials as shown on the following page
- B. Space the tin vanes evenly; curve slightly
- C. Adjust the glass tube so the end is as close to the vanes as possible
- D. Fill pyrex bottle half full of water
- E. Heat water
- F. Explain results
- G. Questions
  1. Why do blades on the turbine have to be curved?
  2. Why does the jet of steam need to be placed on the turbine at an angle?
  3. What other uses could steam generators have?

JOB SHEET #2



SCIENCE IN AGRIBUSINESS AND NATURAL RESOURCES
ENERGY FROM NATURAL RESOURCES

ANSWERS TO JOB SHEETS

JOB SHEET #1--The student will be evaluated according to

A. His ability to follow through the procedure (observed by instructor).

B. Results: The cork has been forced through a distance by the chemical reaction of the vinegar and soda. The force was the CO^2 gas escaping from the bottle after the chemical reaction.

C. Answer to question--So we can control the time when we mix the soda with the vinegar.

JOB SHEET #2--The student will be evaluated according to

A. His ability to follow through the procedure (observed by instructor).

B. Results: As the steam escapes from the end of the glass tube, it forces the cork disc to rotate as the vanes move. The process is repeated each time the vanes come close enough to the end of the glass tube. The more steam pressure developed the faster the disc will turn.

C. Answers to questions

1. The blades need to be curved in order to trap the most amount of steam.

2. If it was placed on the turbine directly, it would not hit the tin vanes to make them rotate.

3. Some of our newest jet planes use this principle in their turbine engines because the steam turbine is capable of developing a great amount of power. This principle is also used in steam generators to generate electricity. Some of the generators in atomic plants use steam turbines to turn generators. Steam turbines could power locomotives, provide for production in industry, run machines for factories, and power steam ships.

SCIENCE IN AGRIBUSINESS AND NATURAL RESOURCES
ENERGY FROM NATURAL RESOURCES

TEST

1. Match terms on right with the definitions associated with power and energy.

____a.	A force through a distance	1.	Force
____b.	An influence that produces motion or that prevents motion	2.	Energy
____c.	Movement	3.	Work
____d.	Ability to do work	4.	Motion

2. List three natural resource forms of energy.

   a.

   b.

   c.

3. Describe transformation of energy.

4. Write the Law of the Conservation of Energy.

5. Match the four job titles on the right to the correct job description.

____a.	Identify fossils and composition of rocks; locate developed mineral resources, sites for bridge foundations, tunnels, and wells	1.	Mining engineers
____b.	Plan and supervise drilling for oil and natural gas; select method for getting oil and gas to surface	2.	Petroleum engineers
____c.	Study earth's physical characteristics, such as its electric, magnetic, and gravitational fields; study the earth's interior heat flow, vibrations, and solar radiation	3.	Geophysicists
____d.	Aid in research for mineral deposits; determine whether deposit exists and is rich enough to mine; determine position of mine and methods of extraction	4.	Geologists

6. List three effects on business due to natural resource energy shortage.

a.

b.

c.

SCIENCE IN AGRIBUSINESS AND NATURAL RESOURCES
ENERGY FROM NATURAL RESOURCES

ANSWERS TO TEST

1. a. 3
   b. 1
   c. 4
   d. 2

2. Any three of the following are acceptable.
   a. Petroleum
   b. Coal
   c. Chemical
   d. Mechanical--Wind and water
   e. Solar

3. One form of energy changed into another form of energy--Mechanical, electrical, heat

4. Energy can neither be created nor destroyed but may be converted from one form to another.

5. a. 4
   b. 2
   c. 3
   d. 1

6. Any three of the following are acceptable.
   a. Transportation or shipping
   b. Production of materials
   c. Price increases
   d. Materials used in production
   e. Fuel for machinery
   f. Heat and cooling for plants or factories